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Gentner's Fritillary (*Fritillaria gentneri*)

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EDITORIAL

This issue of *Kalmiopsis* brings several conservation concerns. First is *Sidalcea hendersonii*, a coastal species whose populations in Oregon have dwindled during the past 100 years down to a single site. Melanie Gisler and Rhoda Love, authorities on all aspects of this species, are leading efforts for listing of this species. In the *Plant of the Year* series, Frank Callahan shares his concerns for *Aesculus californica,* whose Oregon distribution is also limited to a single location. Mariana Bornholdt takes us back in time to the experiences of botanists on the Wilkes Expedition through Oregon in 1841. Michael Murray relates the threats to *Pinus albicaulis*, an important timberline species in Oregon. We learn about the botanists at Crater Lake National Park from Beth Horn and about the discovery and conservation efforts on behalf of *Fritillaria gentneri* from Georgie Robinett. I thank Gene Yates, Candice Guth, Lusetta Nelson, and Frank Lang for writing book reviews. Lastly, we take a moment to honor Scott Sundberg, whose leadership created a strong foundation for the Oregon Flora Project. I hope that in addition to increasing your knowledge of Oregon's native plants and habitats, this issue of *Kalmiopsis* inspires you to work toward their conservation.

Sidalcea hendersonii, female flowers.
Photo by Michael Running.

CONTACT INFORMATION

Kalmiopsis Editor: Cindy Roché, 109 Meadow View Dr., Phoenix, OR 97535, crupinaqueen@charter.net
Bulletin Editor: Tanya Harvey, 40237 Reuben Leigh Rd., Lowell, OR 97452-9712, bulletin@NPSOregon.org
Membership Chair: Clayton Gautier, 3927 Shasta View St., Eugene, OR 97405-4442, membership@NPSOregon.org
Webmaster: Michael Hartman, 1918 Fircrest Dr., Eugene, OR 97403, webmaster@NPSOregon.org
Email Discussion List Login: See NPSO web page, select subscribe to list under membership.
Web Page: http://www.NPSOregon.org

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Cover Photo: Gentner's Fritillary (*Fritillaria gentneri*). Photo by John Erwin, P.O. Box 1333 Grants Pass, OR 97526. April 1990.

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General business address: PO Box 902, Eugene, OR 97440-0902

Henderson's checkermallow: The natural, botanical, and conservation history of a rare estuarine species

Melanie Marshall Gisler
Institute for Applied Ecology, 563 SW Jefferson Ave., Corvallis, OR 97333

Rhoda M. Love
393 Ful Vue Drive, Eugene, OR 97405

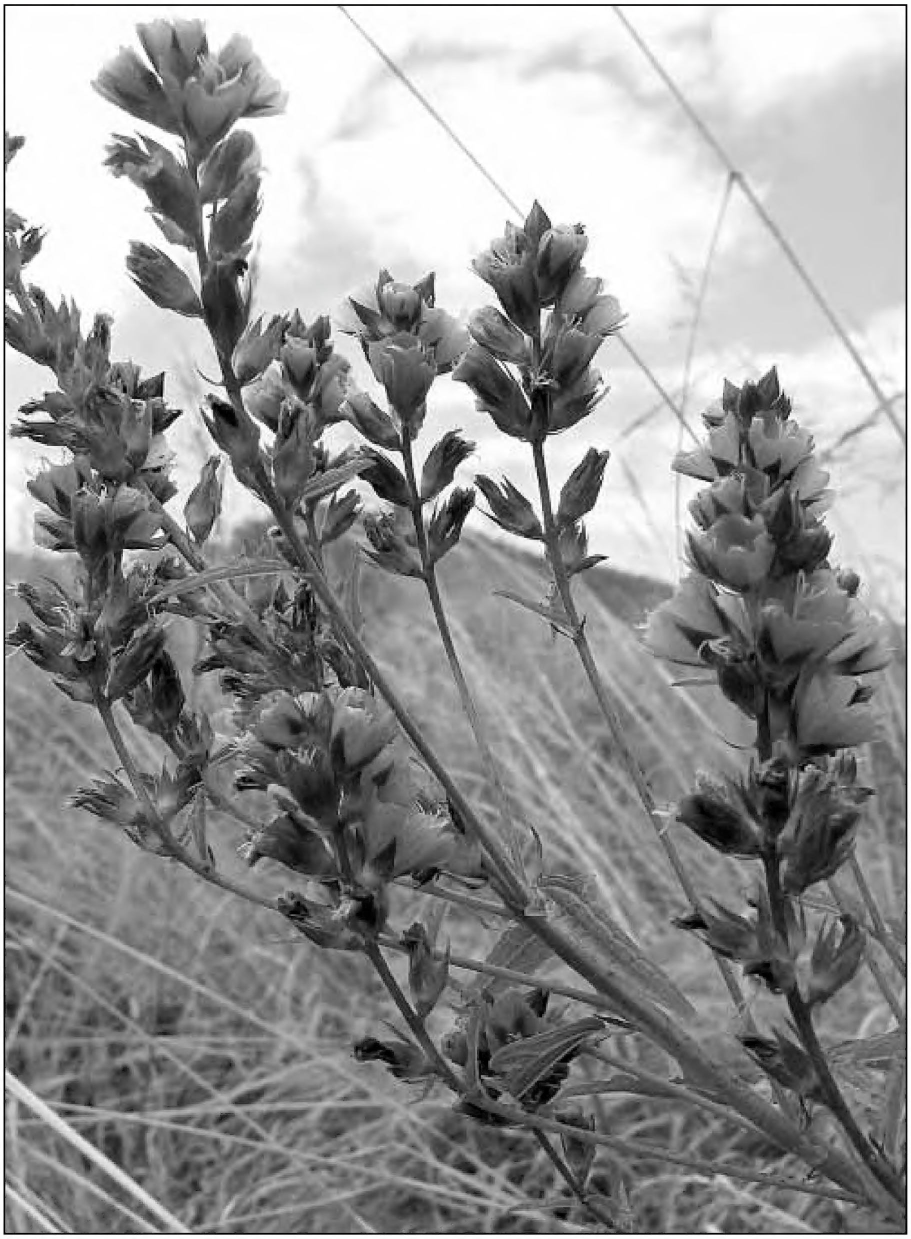
When Louis Henderson collected the type specimen of Henderson's checkermallow (*Sidalcea hendersonii*) in 1887, he could scarcely have foreseen that this beautiful species of Pacific Northwest coastal estuaries would become a forgotten and overlooked member of the region's flora, nor that his namesake would, over 100 years later, become the focus of intensive research and conservation initiatives to rescue it from the brink of extinction. While the plight of this rare member of the Malvaceae is disheartening, research on Henderson's checkermallow has yielded fascinating tales of botanical history, physical peril, sexual intrigue, predatory insects, and scientific discovery. In addition, conservation efforts for this species have provided a useful case study in grassroots activism, endangered species bureaucratic processes, and initiation of recovery actions.

Botanical History

Early Collections

The first recorded human contact with Henderson's checkermallow dates back to explorations of the Wilkes Expedition of 1838-1842 and yielded a specimen preserved in the US National Herbarium Washington DC. For more information on the Wilkes Expedition, see Mariana Bornholdt's article on page 16. The checkermallow was collected in what is now the state of Washington; the label identifies the location as the Satchop (Satsop) River, but it was probably found in tidal areas of the lower Chehalis River. Although undated, the specimen was no doubt collected on July 30, 1841 by botanist William Brackenridge as the Expedition embarked from Fort Nisqually on Puget Sound to begin mapping Gray's Harbor. Originally identified as "*S. malvaeflora*," the specimen was not recognized as *S. hendersonii* until examined by Eva M.F. Roush for her 1931 monograph of the genus.

Following its initial discovery in Washington, Henderson's checkermallow was collected twice in Canada. In 1858, David Lyall (1817-1895), a Scottish surgeon-naturalist posted to the Canadian-American Boundary Survey, collected it on Saturna Island, British Columbia; his specimen is preserved in the Gray Herbarium at Harvard. Initially identified as "*S. campestris*" by Asa Gray, annotations on the sheet indicate that Roush corrected the name to *S. hendersonii*, with later confirmation by C. L.

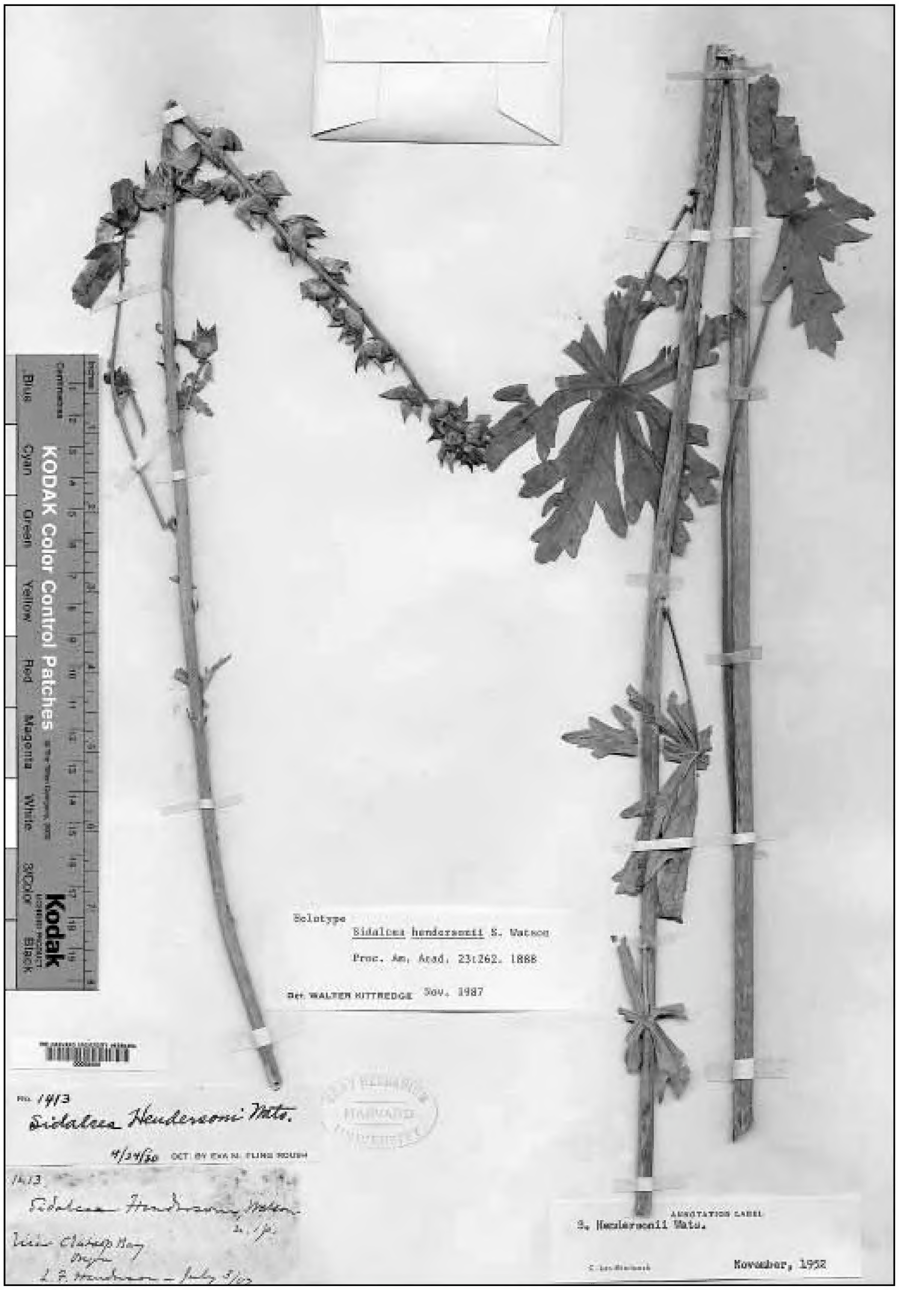


Sidalcea hendersonii at Cox Island, Oregon, July 2004. Photo by Gail Baker.

Hitchcock. In 1883, the well-known Pennsylvania botanist Thomas Meehan found the checkermallow near Victoria on Vancouver Island; his specimen can be seen at the Academy of Natural Sciences in Philadelphia. Meehan called his specimen "*S. malvaeflora*" but his label reveals that he had his doubts about the identification. Eva Roush recognized the specimen as *S. hendersonii* in 1931.

Henderson's checkermallow did not gain its recognized scientific name until 1887, when two Oregon pioneer botanists collected it almost concurrently. Although Louis F. Henderson and Thomas Jefferson Howell often worked together, their respective discoveries of this species were made independently. Howell's collection on June 15th at the mouth of the Umpqua River was the first in Oregon. He labeled it "*Sidalcea campestris*." Two weeks later (July 3rd), Henderson encountered it in the Columbia River estuary, at a location he identified as "near Clatsop Bay." This site does not appear on maps but "Clatsop Beach" is indicated on an early map in the vicinity of Fort Stevens State Park near present day Hammond. Both Howell and Henderson sent their specimens to Harvard, where the Howell specimen was apparently overlooked for a number of years, while Henderson's was named for the collector by Sereno Watson. Both collections can be studied at the Gray Herbarium today.

Other early collectors of *Sidalcea hendersonii* in Oregon included Morton E. Peck of Willamette University who found it at Nestucca Spit in 1909, and at Sand Lake and Cannon Beach in 1924. LeRoy Abrams of Stanford collected it at Seaside in 1922, and Henderson collected it two more times, first at Cannon Beach in 1929 and again at Florence in 1931. C. L. Hitchcock of the University of Washington made a collection north of Reedsport in 1951.


KODAK Color Control Patches
Blue
Cyan
Green
Yellow
Red
Magenta
White
3/Color
Black
Kodak
Holotype
Sidalcea hendersonii S. Watson
Proc. Am. Acad. 23:262. 1888
Det. WALTER KITTREDGE Nov. 1987
No. 1413
Sidalcea Hendersoni Wats.
4/24/30 DET. BY EVA M. FLING ROUSH
1413
Sidalcea Hendersonii Watson
near Clatsop Bay
Oregon
L. F. Henderson – July 3/87
GRAY HERBARIUM HARVARD UNIVERSITY
ANNOTATION LABEL
S. Hendersonii Wats.
C. Leo Hitchcock
November, 1952

Holotype of *Sicalcea hendersonii* collected by Louis F. Henderson "near Clatsop Bay, Oregon" on July 3, 1887. Note annotations by Eva M. F. Roush, and C. L. Hitchcock. Courtesy of the Gray Herbarium, Harvard University.

Sidalcea Origins and Taxonomy

The genus *Sidalcea* A. Gray (Malvaceae) comprises annual and perennial herbs inhabiting western North America from the Rocky Mountains west to the Pacific coast, and from Mexico north to British Columbia. Although Eva Roush (1931) suggested that *Sidalcea* originated in Mexico and spread northward, recent molecular studies do not completely support this theory (e.g. Andreason and Baldwin 2003). Steven R. Hill, author of the treatment for Malvaceae in The Jepson Manual (Hickman 1993), has studied phytogeographic evidence for *Sidalcea* and proposes that a California-Sierran origin is more likely (Hill, pers. comm.). Floras recognize at least 18 species in California (Hickman 1993), 13 species in Oregon, and 3 species in Washington (Hitchcock *et al.* 1961), and 2 species are known from Mexico (Fryxell 1998). Among checkermallow species, *Sidalcea hendersonii* has the most northerly distribution, with several populations scattered up the British Columbia coastline and a single occurrence discovered in 2003 near Juneau, Alaska. The latter represents the first record of Malvaceae in Alaska's diverse native flora. A conspicuously tall plant, Henderson's checkermallow reaches nearly 5 feet in height, and is distinguished from other checkermallows primarily by its habitat and by its glabrous foliage and smooth carpels. Henderson's checkermallow is found only in tidally influenced areas where fresh water from lakes or streams meets salt water of the Pacific Ocean. Some of its salt marsh-adapted associates include Pacific silverweed (*Argentina egedii* ssp. *egedii*, syn. *Potentilla anserina* ssp. *pacifica*), western yarrow (*Achillea millefolium*), seacoast angelica (*Angelica lucida*), and tufted hair-grass (*Deschampsia caespitosa*). No other

Sidalcea species is known to occupy estuarine habitats.

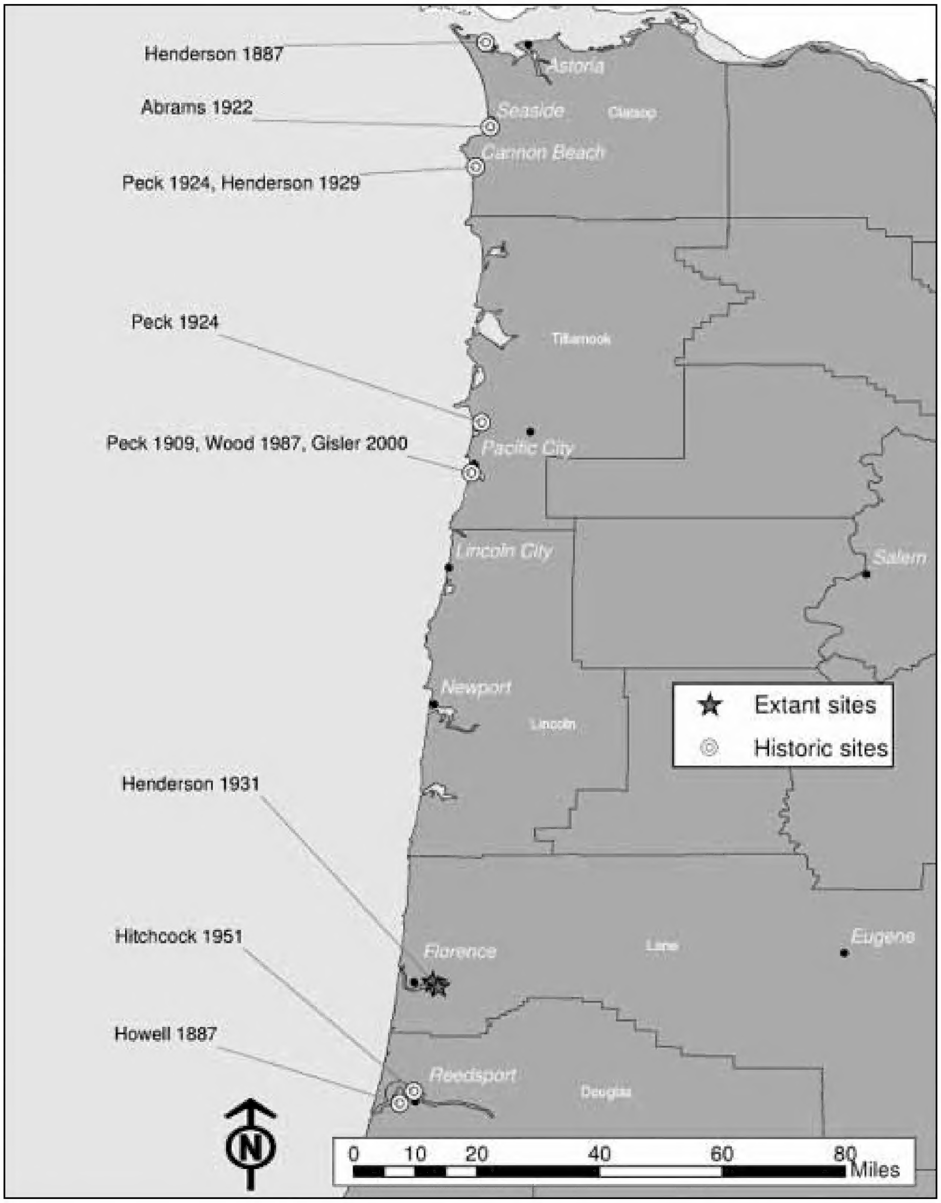
Sidalcea hendersonii fruit, a 5-9 seeded schizocarp. Photo by Helen Kennedy.

Although other *Sidalcea* species with overlapping ranges can hybridize (Gisler 2003), interspecific mating is unlikely in Henderson's checkermallow because it is isolated by its estuarine habitat. *Sidalcea hendersonii's* nearest taxonomic relative is not entirely clear. While Roush (1931) thought *S. hendersonii* most closely resembled *S. candida* and *S. oregana*, Hitchcock and Kruckeberg (1957) ultimately placed it with *S. cusickii* on the basis of pubescence, flower size, and carpel characteristics. More recently, Andreasen and Baldwin (2003) positioned *S. hendersonii* closest to *S. virgata* based on a genetic analysis of nuclear ribosomal DNA, but their study did not include *S. cusickii* or *S. campestris*. If one of these species is the progenitor of *S. hendersonii*, then the latter likely evolved in the estuaries of the central Oregon coast, where drainages from interior valleys provide migration corridors to the Pacific Ocean for both putative ancestral progenitors.

Modern Conservation Status: Where have all the flowers gone?

Historically, Henderson's checkermallow was neither rare nor ephemeral. Indeed, pollen dating back approximately 3700 years (Mathewes and Clague 1994) infers the long term presence of *S. hendersonii* in British Columbia. The early collections of Henderson's checkermallow in Oregon, Washington, and British Columbia indicate that this species was once much more common than it is today.

Regrettably, the gradual decline of this species long proceeded unnoticed, despite the disappearance of its showy pink flowers and the obvious loss of estuarine habitats to agricultural and urban development. In 2002, during her biographical investigations of pioneer botanist, Louis Henderson, Rhoda Love realized that there had been few recent reports or collections of *Sidalcea hendersonii* in Oregon. Furthermore, the botanical community had little knowledge of extant populations. Her concern was translated into a mobilization of population searches in the summers of 2003 and 2004. These searches revealed reduced abundance and distribution in Oregon, where known populations have decreased from ten to only one (Love 2003). Fortunately, the species has fared somewhat better in Washington and British Columbia, although it is still considered rare in these regions. Worldwide, it is believed fewer than 100 sites remain for this species, most occurring within vulnerable, privately owned habitats (Love 2003).



Extant and historic *Sidalcea hendersonii* populations in Oregon are referenced by the last name of the reporter and year of collection or sighting. The only extant population is located in the Siuslaw River estuary near Florence.

Status in Oregon

Jean Siddall (1930-1997), founder of the Oregon Rare and Endangered Plant Project, together with Kenton L.

Chambers of Oregon State University, instituted searches of historic Oregon *Sidalcea hendersonii* sites in the 1970s. Alarmingly, the estuarine checkermallow was relocated at only one site, in Tillamook County. For reasons not well understood, this extinction rate did not trigger automatic listing of the plant by the Oregon Department of Agriculture Plant Conservation Biology Program following its establishment in 1987. The US Fish and Wildlife Service has, thus far, not listed the plant as threatened, perhaps because extant populations remain in Washington. However, when alerted in April 2003 by the Native Plant Society of Oregon (NPSO) to the fact that the species seems on the point of disappearing from our state, the Oregon Natural Heritage Information Center at OSU upgraded *Sidalcea hendersonii* to its List 1 (Endangered or threatened throughout its range) and raised its global rank to G3 (Rare, threatened or uncommon throughout its range).

The Only Known Population in Oregon

Today, the only known surviving population of Henderson's checkermallow in Oregon occurs in the Siuslaw River estuary of Lane County. Intensive field searches of historic *Sidalcea hendersonii* sites and potential habitat by nearly two dozen botanists in 2003 and 2004 failed to relocate the species elsewhere in the state, aside from a single individual near Sand Lake in Tillamook County. The largest of the Siuslaw River occurrences is located on Cox Island, about three miles east of Florence. The Nature Conservancy (TNC) acquired the island in 1976 as a gift from a timber company, Champion International. The importance of *Sidalcea hendersonii* on this 188-acre island was taken into account in 1995 when the TNC established a conservation management plan for the island. Monitoring of the species by the Conservancy began in 1999.

Today approximately 545 individuals of Henderson's checkermallow are protected on Cox Island. Robert Frenkel of Oregon State University, an expert on salt marsh ecosystems, has written of the population, "The habitat is not too encouraging for the long-term survival of the species. It is mostly confined to the upper edge of the salt marsh which tends to be a highly disturbed habitat where logs, boards, wracks of algae and other flotsam accumulate and roll around under high tide conditions" (R. Frenkel, pers. comm.). Successional changes and invasion by non-native species also threaten its long-term survival on Cox Island.

Conservation Efforts in Oregon

Conservationists hope that increased public awareness of Henderson's checkermallow will yield reports of additional populations. If they are found on private land, we will endeavor to protect them under a conservation agreement or convert the land to public ownership where it can be managed for native estuarine species. While several checkermallow occurrences are known from the Siuslaw estuary area, currently only the Cox Island population is protected. However, the McKenzie River Trust of Eugene is working to acquire conservation easements at the other sites.

Recovery of Henderson's checkermallow in Oregon may ultimately require a reintroduction program. NPSO is supporting a study through the Leighton Ho Memorial Field Botany Award that will identify appropriate habitats for reintroduction of Henderson's checkermallow. Cultivation of this species is not expected to be a barrier to reintroduction efforts as the Institute for Applied Ecology in Corvallis has already propagated Henderson's checkermallow from seed collected at Cox Island Oregon in 2003. Although germination was low, seedling survival was high, and the majority of the plants flowered in the first year. Currently, several hundred healthy, potted Henderson's checkermallow plants await transplanting to the Oregon coast. Given the success of reintroduction programs for other rare checkermallow species (Gisler 2002), we are optimistic that these transplanting efforts will result in new populations when suitable and secure introduction sites are found.

Legal Protection:
NPSO Petitions State and Federal Agencies

In late 2003 the NPSO Board of Directors voted to petition the Oregon Department of Agriculture (ODA) Plant Conservation Biology Program and the United States Fish and Wildlife Service (USFWS) for listing of *Sidalcea hendersonii* as Threatened. NPSO

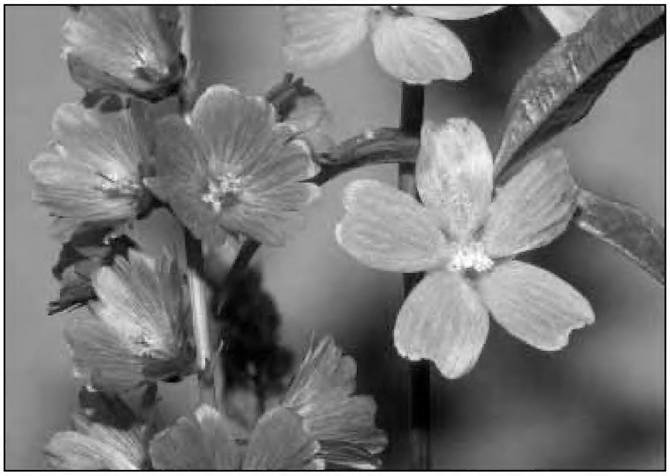
Sexual Dimorphism

Spotting female Henderson's checkermallow plants in the field, even from a distance, is easier than it might sound. Female flowers can readily be distinguished from bisexual flowers not only by a lack of pollen, but also because female flowers are substantially smaller and of darker pink pigmentation. Interestingly, male-sterility in gynodioecious species is frequently associated with a reduction in flower size (Darwin 1877, Ashman and Stanton 1991, Delph 1996). The mechanism responsible for the floral dimorphism is not completely understood. Darwin (1877) suggested that this pattern had nothing to do with natural selection; rather it was due to a developmental connection between stamens and petals. Indeed, experimental evidence suggests that hormones associated with pollen development are at least partially responsible for the relationship between flower size and sex. In another gynodioecious species, Plack (1957) found that removing the stamens of bisexual flowers at bud stage reduced their corollas to the size of female corollas. She could reverse this process by adding gibberellic acid, a hormone associated with male sex expression.

One field guide suggested a possible trimorphism for *Sidalcea hendersonii*: "A remarkable feature is the occurrence of 3 kinds of flowers. In addition to the large 1 inch, perfect flowers…occasional flowers in the spike-like racemes are but ½ inch wide (though perfect), and there are also similar small blooms that are imperfect, lacking anthers" (Clark 1973). However, after measuring the petals of thousands of female and hermaphrodite individuals in six populations, Marshall (1998) concluded that only two floral forms exist: large-flowered bisexual and small-flowered female flowers. The impression of trimorphic flowers is understandable because females occasionally exhibit "dummy" (sterile) stamens.

petitions, delivered to the agencies in December 2003, summarized the decline of the species and made a case for granting it legal protection. In response, Dr. Robert Meinke of ODA stated that NPSO's petition justified a "full status review." The Acting Regional Director of USFWS in Portland replied that their initial review of the petition did not indicate that an emergency situation existed, and they anticipated making an initial finding in Fiscal Year 2005.

Despite frustration with the slow pace of agencies in the process of listing, NPSO remains optimistic for legal protection of the species and looks forward to working with ODA and USFWS to assist the recovery of Henderson's checkermallow in Oregon.



A striking sexual dimorphism in Henderson's checkermallow is readily apparent by comparing the large, pollen producing bisexual flowers (right) with small, dark pink, female flowers lacking pollen (left). Photo by Helen Kennedy.

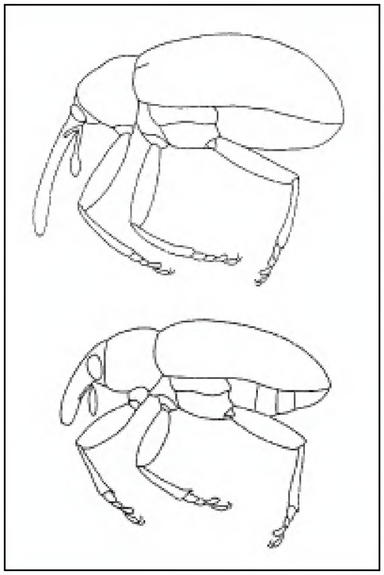
Mysterious Mating System

Cloaked behind its distractingly attractive displays of bright pink flowers, Henderson's checkermallow exhibits an unusual and evolutionarily perplexing sex life. Many students of botany are familiar with the three routine plant mating systems: bisexual flowers (male and female organs on the same flower), monoecy (separate male and female flowers on the same plant), and dioecy (male and female flowers on different plants). Henderson's checkermallow, however, possesses an uncommon mating system often overlooked in basic botany texts called "gynodioecy." Gynodioecious populations contain two (coexisting) types of plants: plants with all bisexual flowers and plants with all female (male-sterile) flowers. Gynodioecy is considered to be derived from the bisexual system, often as an intermediate step in the evolution of dioecy (Lloyd 1974). It is estimated that gynodioecy occurs in only 7% of species (Richards 1986), but the fact that it exists at all has baffled evolutionary biologists since the time of Charles Darwin (1877). How are females maintained in these populations when they seem to have a reproductive disadvantage? Female plants contribute genes to the next generation only through their ovules (which become seeds), whereas bisexual plants have two opportunities to pass on their genes, through both pollen and ovules. Female plants must produce significantly more seeds than bisexual plants for male sterility mutations to be maintained in gynodioecious populations (Charlesworth and Ganders 1979).

In the case of Henderson's checkermallow, Marshall and Ganders (2001) showed that females did indeed exhibit higher fitness, producing more surviving offspring than bisexual plants in an experimental population. However, when seed production was compared in natural populations in British Columbia, no female fitness advantages were evident. Moreover, the average female frequency in these same populations was 39%, greatly exceeding the 20% frequency exhibited by most gynodioecious species. If these high female frequencies weren't attributable to higher seed production, could it be alternatively explained by the genetics of male-sterility inheritance? After all, complex interactions between genes in the nucleus and cytoplasm favor female offspring and are common in other gynodioecious species, including the related species, *S. oregana*. ssp. *spicata* (Ashman 1992). However, crosses in *S. hendersonii* indicated simple Mendelian (nuclear) patterns of inheritance, offering no genetic advantages to females (Marshall and Ganders 2001). By this point, it looked like evolution of gynodioecy in *Sidalcea hendersonii* would remain an unsolved mystery.

A surprise explanation for females

In Henderson's checkermallow the persistence of the unusual breeding system, gynodioecy, could not be explained by higher female fitness or genetic control of male sterility. But in the fall of 1994, in a musty, dimly lit hotel room, researchers from the University of British Columbia made a fascinating discovery. While inspecting *S. hendersonii* fruits collected earlier that day from Vancouver Island, it became evident that many seeds were damaged by weevils, and most of this damage occurred on seeds from bisexual plants. It followed that although production of seeds was equivalent between female and bisexual plants, actual seed survival was much lower in bisexual plants due to selective predation by weevils (Marshall and Ganders 2001). This discovery may explain why female plants are maintained in Henderson's checkermallow populations. Until that time, the role of seed



Anthonomus melancholicus (top) and *Macrorhoptus sidalcea* (bottom). *Anthonomus* preferentially consumed bisexual seed in BC populations (Marshall and Ganders 2001), while *Macrorhoptus* did not appear to be a sex-biased predator. Female *Macrorhoptus* weevils oviposit eggs in immature carpels and the larvae complete their development in the fruit. The larvae feed on the interior of each seed, moving from one seed to the next through small tunnels they create. In contrast, *Anthonomus* weevils appear to consume the entire fruit, leaving only fat larvae and frass resting in the bottom of an empty calyx. Weevils are approximately 3 mm long. Drawing by L. Lucas.

Henderson Collects Type Specimen

by Rhoda M. Love

The date was Sunday, July 3, 1887 – the day before Independence Day. No bridge spanned the Columbia River at Astoria, no dams impounded the great river, and the Corps of Engineers had just begun work on the South Jetty. The American Frontier was moving westward; Oregon had achieved statehood, but Washington would remain a Territory for two more years. Democrat Grover Cleveland was President, and Asa Gray was curator of the herbarium at Harvard University.

On this day Louis F. Henderson set out to indulge in his favorite pastime, searching for new plant species. Henderson was 34; he had been married to his wife Kate for four years and had a year-old daughter, Margaret. (Their second daughter, Constance, would be born the following year.) Henderson was a teacher of languages, elocution and botany at Portland High School. He and his family frequently spent summers at the beach home of his mother-in-law at Ilwaco near Long Beach, Washington Territory. It seems probable that, to botanize the salt flats and marshes between Point Adams and Young's Bay of Oregon on this holiday weekend, he crossed the broad mouth of the Columbia River on a private fishing vessel.

Once amid the grasses and reeds of the Columbia estuary, Henderson no doubt began to get his feet wet in the muddy, channeled soil that had just begun to dry out after the river's annual spring floods. The weather was likely gray and wet in the morning, fog mixing with the tang of salt spray from nearby Clatsop Spit. Peering through the mist, the botanist must have spotted the waist-high spikes of bright pink flowers and recognized the plant as a checkermallow. Two species had previously been identified from Oregon: *Sidalcea oregana* in 1849, and *Sidalcea campestris* in 1885. Carefully he picked a flowering stem with basal leaves and folded it into a bed of damp grasses in his tin vasculum. When he returned to Ilwaco that evening he would have added a label with date and location and pressed the specimen between newspapers and blotters.

We do not know what other species Henderson collected that day at "Clatsop Bay," because most of his specimens burned in a tragic herbarium fire at the University of Idaho in 1906. However, this particular checkermallow, which Henderson may have recognized as a new species, was sent to Harvard's Asa Gray for identification. Unknown to Henderson at the time was the fact that Asa Gray was ill; the Harvard botanist would die the following January, before dealing with the salt-loving checkermallow. It fell to Gray's successor Sereno Watson to name the plant. Watson honored the young schoolteacher-explorer in 1888 by giving it the name *Sidalcea hendersonii*, Henderson's checkermallow. As for Henderson himself, our guess is that he returned to his family at Ilwaco that Sunday evening tired and muddy, with wet shoes and socks, put his plants in press, slept well, and awoke the next morning to enjoy the festivities of an American Independence Day.

Louis F. Henderson (1853-1942) as the botanist appeared about the time he collected the type specimen of *Sidalcea hendersonii*, named for him by Sereno Watson. Photo courtesy of the Henderson family.

predation in breeding system evolution had received minimal consideration.

Two species of Curculionid beetles (weevils) parasitize seeds of Henderson's checkermallow, *Macrorhoptus sidalcea* and *Anthonomus melancholicus* (identified by Dr. Horace Burke, Professor Emeritus, Texas A&M University, and Dr. Robert Anderson, Canadian Museum of Nature), but only one of these has been identified as a selective predator. At a mainland BC population harboring only *Macrorhoptus* weevils, female and bisexual plants experienced equal levels of seed predation, while at five populations on Vancouver Island where *Anthonomus* weevils were dominant, sex-biased seed predation was obvious. At these island populations, weevil larvae destroyed significantly more seeds from plants with bisexual flowers. Not surprisingly, more female plants occurred in populations that experienced this preferential feeding pattern. *Sidalcea hendersonii* provided the first clear evidence that sex-biased predation may be responsible for high female frequencies in a gynodioecious species. The reason for discrimination between bisexual and female flowers was not investigated, but adult *Anthonomus* weevils are known to feed on pollen, and scientists suspect that pollen (obviously lacking in female flowers), is what attracts weevils to bisexual flowers. After dining on pollen, weevils have little incentive to migrate elsewhere before mating and laying their eggs.

Applying Breeding System and Seed Predation Research to Conservation

Although breeding system issues may not pose the most significant threat to the survival of Henderson's checkermallow, subtle effects can undermine resilience and survival when populations are small and threats are numerous. As populations shrink and become isolated, the probability of inbreeding increases (Jain 1976). Marshall and Ganders (2001) found that inbreeding in Henderson's checkermallow was correlated with reductions in seed production, germination, survival, and flowering. Also, high numbers of females in gynodioecious populations could limit pollen flow, thus impacting seed production and recruitment of new individuals. Pollen flow could be a particularly important concern at the North Fork of the Siuslaw River, where the frequency of females within Oregon's last remaining Henderson's checkermallow population exceeds 50%. Future reintroduction efforts should endeavor to plant an adequate number of bisexual individuals in key locations near females.

Likewise, seed predation should not be overlooked as a potentially formidable threat. The infamous boll weevil, another

Anthonomus species, parasitizes cotton crops (another member of the Malvaceae) causing at least 200 million dollars worth of damage each year (White 1983). In the Threatened species *Sidalcea nelsoniana*, weevils have been identified as a primary threat to reproductive success and population viability (Gisler and Meinke 1997). In Oregon's Siuslaw estuary, both *Anthonomus* and *Macrorhoptus* weevils were collected from Henderson's checkermallow plants. *Anthonomus melancholicus* weevils can be voracious predators, occasionally consuming every seed produced by a plant (Marshall 1998). A preliminary evaluation of 340 fruits from 18 individuals at Cox Island revealed a reduced reproductive capacity for these checkermallow plants, with 31% of seeds destroyed by weevils and an additional 32% of seeds either unfertilized or aborted (M. Gisler, unpublished data).

Suddenly overtaken by the tide while studying a Henderson's checkermallow population on Vancouver Island BC, Melanie Gisler treads water to protect collections. Photo by Lesley Esford.

Conclusion

Henderson's checkermallow is vulnerable to numerous anthropogenic, environmental, and biological threats. We are fortunate that one population still exists in Oregon, though its long-term survival is uncertain. Active intervention through continued research, legal protection, habitat management, land acquisition, and reintroduction will all be necessary if we hope to restore this fascinating and beautiful salt marsh species in our state.

Acknowledgments

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Tides!

By Melanie M. Gisler

For adventurous souls wishing to see Henderson's checkermallow in its native habitat, I feel compelled to share one of my salt marsh field experiences with you. Having spent the majority of my life in the landlocked, desert state of New Mexico, I was completely unprepared for the vicissitudes of a Northwest estuary. Joined by my invaluable field assistant, Lesley, and trusty canine, Zooey, I foolhardily set out on the first field excursion of my graduate thesis. The objective of our day's work was to count Henderson's checkermallow females and measure flower petals with digital calipers at Ladner Marsh, near Vancouver, BC. Our clumsy attempts to carry out this delicate work were initially amusing, as we found ourselves repeatedly stumbling into treacherous, muddy tidal channels concealed by dense vegetation. By late afternoon we were deep into the marsh. While Zooey busied himself stalking and attacking innocent cattail heads, Lesley, the pragmatic member of our group, began nervously eyeing the water, which was climbing ever higher on our rubber boots.

Unconcerned, we opted to ignore the rising tide and collect more data before calling it a day. However, only minutes later the cool seawater rapidly rose from ankle to mid-calf. Although my shepherd-cross is a good sport in most situations, at this point even he seemed doubtful we could navigate or swim through the overpowering plant life and avoid plunging into the surprise channels, now completely filled with the rising water. As the advancing tide continued to envelop us, we realized that we could drown! Hastily securing data and equipment, we dragged ourselves through the quagmire, desperately clinging to injuriously sharp sedges for stability. When the chilling cold water topped our boots, I experienced a sickening feeling of claustrophobia. I was responsible for my friend, my dog, my own life, and my data. Succumbing to panic, I suddenly noticed that Zooey was intentionally avoiding particular sections of marsh for no reason apparent to my comparatively dull human senses. Investigating with a stick I realized that he was somehow able to detect the dangerous channels, now submerged under several feet of water. The canine became our leader. With clothing now drenched up to our waists and our field equipment and data raised high above our heads, we scrambled and splashed through one last obnoxious clump of purple loosestrife before miraculously floundering onto dry land. Looking like creatures from the black lagoon, we gawked at the nightmare from which we just emerged. Now that we were safely removed, the estuary somehow no longer seemed so threatening. In the distance we could see the lovely pink wands of checkermallow flowers swaying gently with the motion of the tide, as if waving goodbye. Peace restored, we vowed from that day forward to study tide charts religiously and carry a small inflatable raft (just in case).

Henderson's checkermallow. We are grateful to Neal Hadley and Kevin Anderson for their good work with Henderson's checkermallow while TNC stewards for Cox Island. Thanks also to Frank Lang, Susan Kephart, and Fred Ganders for reviewing the manuscript and to Steven R. Hill for his insights on *Sidalcea*.

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Melanie Gisler is a botanist with the Institute for Applied Ecology, a nonprofit conservation organization based out of Corvallis, Oregon. Currently the Program Manager for their Native Seed Network website (www.nativeseednetwork.org), she has been working in plant conservation and habitat restoration for more than a decade in the diverse floras of New Mexico, British Columbia, Texas, and Oregon. Melanie moved from the southwest to the Willamette Valley to be with fellow checkermallow researcher and weevil enthusiast, Steve Gisler.

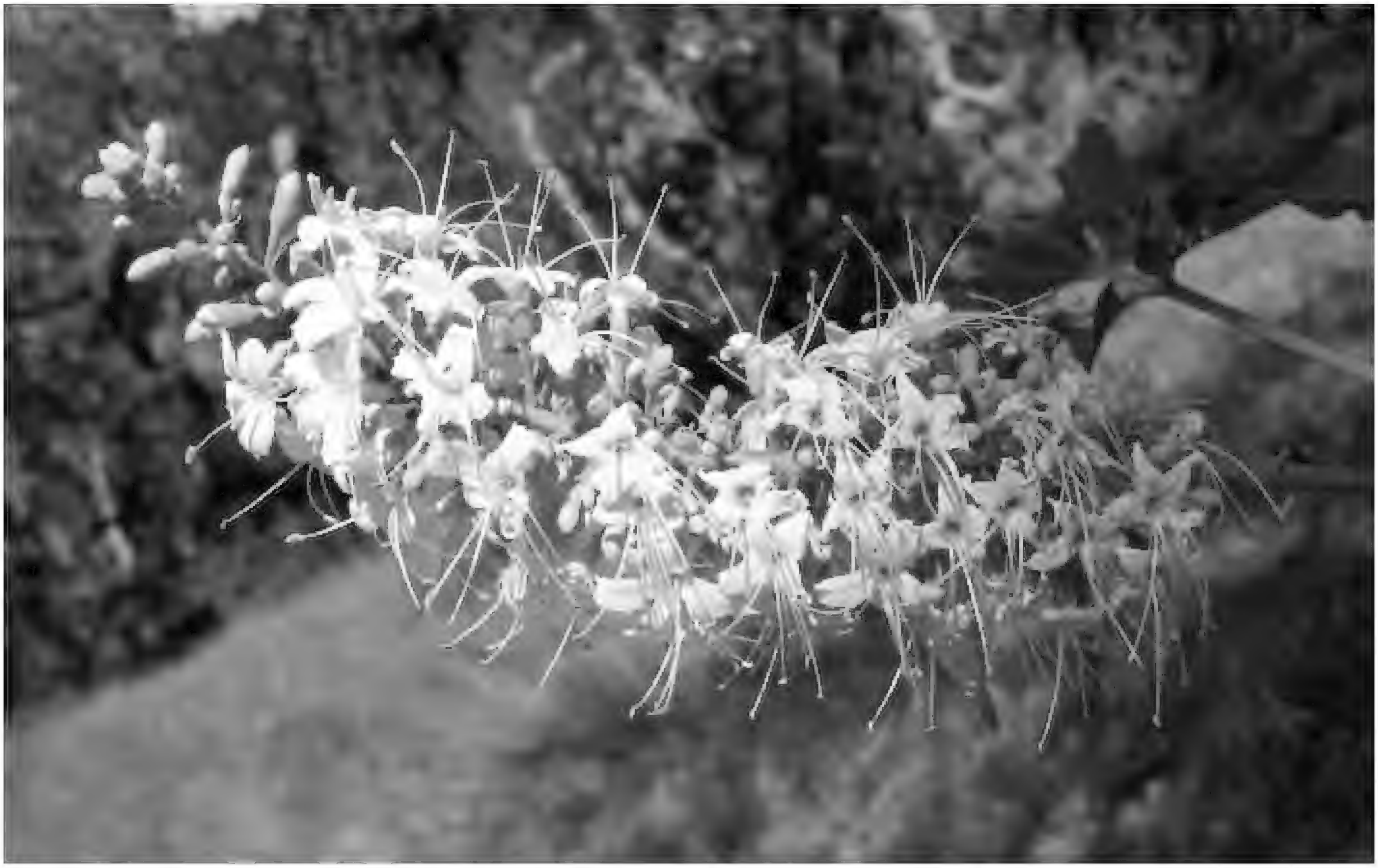
Rhoda Love is Vice President of the Native Plant Society of Oregon and the Conservation Chair of NPSO's Emerald Chapter. She has dedicated herself for forty years to the protection of the Northwest's native plants and habitats. Rhoda is a retired college teacher and the biographer of Louis F. Henderson. She and her husband Glen live in Eugene and have two grown children and two grandchildren.

Authors' Note: As this issue of *Kalmiopsis* was going to press, NPSO was notified by the Oregon Department of Agriculture that its petition to list *Sidalcea hendersonii* as Threatened in Oregon had been denied. Please watch for more information in the NPSO Bulletin.

PLANT OF THE YEAR

California Buckeye (*Aesculus californica* (Spach) Nutt.)

Frank Callahan
PO Box 5531, Central Point, OR 97502



California buckeye (*Aesculus californica*) bears multi-flowered spikes that measure 2½ inches across and 6 to 9 inches in length. Photo by Cindy Roché.

California buckeye (*Aesculus californica*) is apparently quite rare in Oregon, known only in the hills near Gold Hill in Jackson County. The largest population is on Hidden Valley Ranch where a proposed subdivision development threatens its habitat (Mann 2005).

California buckeye was discovered in the early 1800s in California and described by Edouard Spach in 1834 (Little 1979, Hickman 1993). He named it *Calothyrsus californica* (*calo* = beautiful, *thyrse* = cluster), and indeed it has a strikingly beautiful flower cluster, not to be confused with any other Western native species. However, four years later, Harvard botanist and ornithologist Thomas Nuttall reclassified the species, placing it in the genus *Aesculus*. The name *Calothyrsus* seems more appropriate, as *Aesculus* is an ancient Latin name of a European oak or other mast-bearing tree, neither of which applies to the spreading, round-crown, palmate-leaf buckeye.

Recently, *Aesculus* was reclassified from Hippocastanaceae to the family Sapindaceae in subfamily Hippocastanoideae (Thorne 2000, and R. Thorne, pers. comm.). It is closely related to the subfamily Aceroideae (maples). The genus *Aesculus* comprises seven species in North America, one in southeastern Europe, and five in India and eastern Asia. The genus *Billia* (an evergreen buckeye) has two species that range from southern Mexico to tropical South America (Mabberley 1993). California buckeye is one of two species of buckeye in western North America. The other is Parry buckeye (*A. parryi*), which grows in Baja California Norte in Mexico.

A small tree, California buckeye is recognized by its smooth, light gray bark, palmately compound leaves, and showy spikes of pinkish white flowers. It is one of the earliest trees to flush vibrant green leaves in spring, but tardily reluctant to flower, perhaps to miss late frosts. Flowers open in late May. It is so adapted to drought that it shuts down leaf activity in late summer and carries on photosynthesis in the bark and fruit pods. In late fall, the large seeds are slowly released from the 2- to 4-inch long pear-shaped pods that split as three-piece valves. The wood is very close-grained, light ivory in color and lightweight. It is highly resistant to decay, but vulnerable to wood borers (Peattie 1953).

California buckeye is often a multiple-trunked, round-domed small tree that adds character to a landscape. The largest tree I have

Poisonous to European honeybees, California buckeye flowers are a favorite of pale swallowtail butterflies. Photo by Bob Korfhage.

measured was 16 feet in circumference and only 28 feet tall; it grows in central California about two miles inland on the main highway to Carmel. At five feet in diameter, it also has the largest bole reported for the species (American Forests, National Champion trees). I can only guess its age (ancient!); its stature is a stubby trunk with gnarled branches, and a gash on its trunk from a bulldozer—one tough tree!

All parts of California buckeye are toxic to humans and livestock. Poisoning is from glycosidal compounds that are present in all plant parts. Humans have been poisoned by honey made from the flowers (USDA Forest Service 1974). The flowers are toxic to European honeybees (*Apis mellifera*); however, native pollinators relish the collection of nectar without side effects. The adult pale swallowtail butterfly (*Papilio eurymedon*) appears particularly fond of this plant.

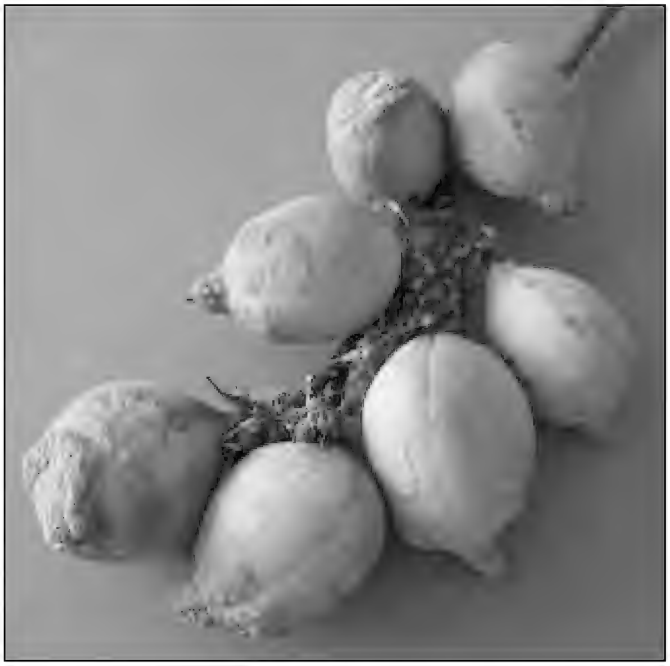
Discovery in Oregon

California buckeye was not known in Oregon until I discovered it in 1970. I encountered it just after I purchased some property south of Foley Lane near Gold Hill in Jackson County. My neighbor, Ray Mitchell, had started a firewood business on his 200 acres. Long woodpiles were stacked on both sides of the access road leading to my property. I noticed that some of the cordwood had an unusual smooth gray bark, unlike the common oak, madrone, and manzanita that made up the bulk of the firewood. I asked where these trees with gray bark had been harvested, and Ray responded that they were “wild pears” and that the trees were all dying because of lack of rainfall. When I saw them in late summer I realized that, despite the pear-shaped fruit and dull brown leaves, these were not pears, but horse chestnuts, and they were not dying. In response to summer drought, California buckeye leaves turn brown, continuing to hang dormant on the trees until autumn.

Ray and I finally visited his wood cutting site in 1992 and sawed a “cookie” (round cross-section) from a California buckeye stump. I sanded and polished the disk to a satin smooth finish and counted the rings. The radius was 6.5 inches; with the ring count indicating 142 years, I calculated that the tree was a seedling in 1850! This specimen was not the largest stump we found, but it yielded the most complete cross-section for counting the growth rings. Larger stumps, up to 23.5 inches in diameter, were encountered, but hollow centers and borer damage limited their usefulness for accurate ring counts. The largest live trees reached 30 feet in height, and we estimated their ages between 250 and 280 years, which equated to seedlings in the early 1700s (before Anglo-European presence). Ray’s misunderstanding of these trees as dying “wild pears” led to the cutting of the entire stand at the woodcutting site. However, the buckeyes and the madrones all resprouted and grew into multi-trunked trees. All of the old growth trees were harvested for firewood, but recruitment of replacements is good on the site, with seedlings in addition to the resprouted adults.

Tracing the origin of California buckeye in Oregon

The obvious question is how did this disjunct population of California buckeye become established in Jackson County, Oregon? In California, there is ample evidence that native tribes utilized the seeds to stupefy fish and to grind the fruits into a nutritious flour (after leaching out the toxins with boiling water). However, the suggestion that Native Americans introduced California buckeye in Oregon lacks supporting evidence. No campsites have been located in the hills where buckeye is found; most aboriginal campsites exhibit a valley or riparian settlement pattern. There is a large gap in the buckeye distribution, with no populations present between northern Siskiyou County,



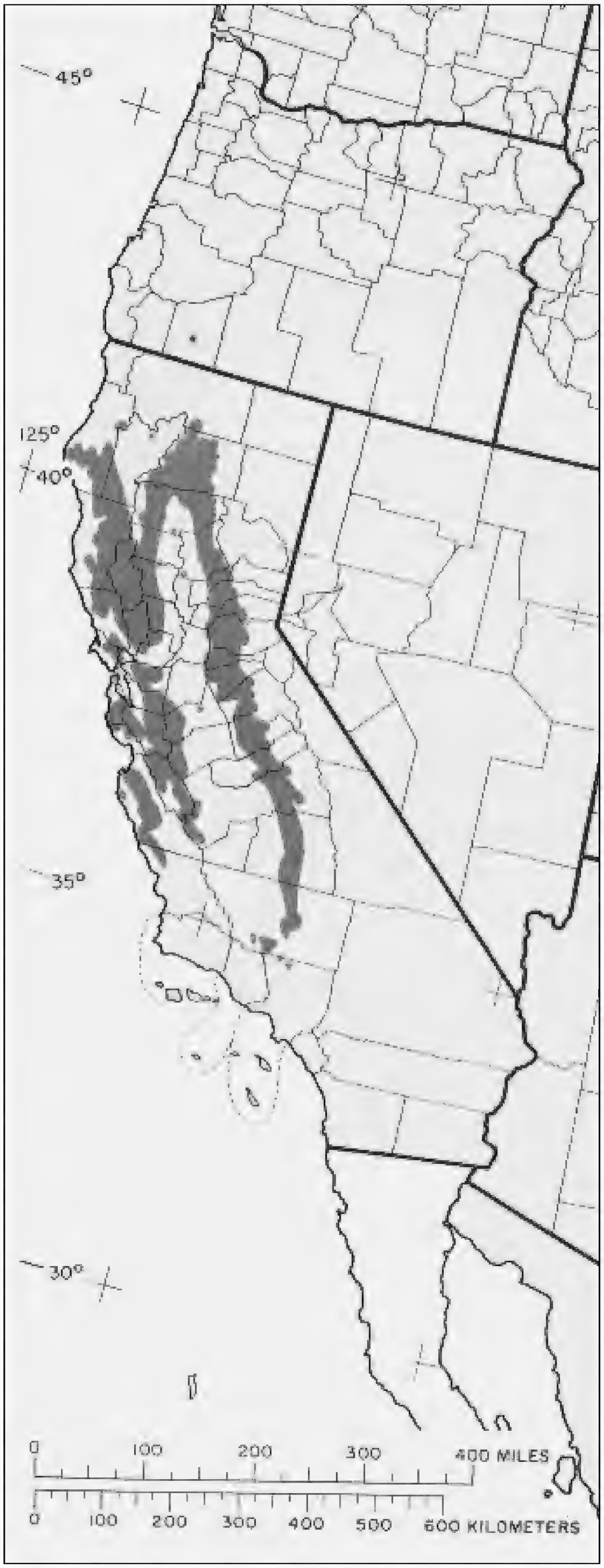
Pear-shaped fruits measuring 2 to 4 inches long are produced in autumn. Photo by Cindy Roché.

California, and southern Jackson County, Oregon, despite the presence of Native American sites and abundant habitat.

In the sections to follow I investigate probable origins of California buckeye in Oregon, using evidence from the fields of geology, paleobotany, ecology, meteorology, and soil science.

Paleofloristic Clues

Oregon's fossil records indicate the presence of California buckeye's ancestors and associates some 20 to 30 million years ago. In an extensive study of the petrified forest of Sweet Home in Linn County, Irene Gregory (1968) catalogued 54 different fossil woods, including buckeye. In the Rogue Valley of Jackson County (due south of Linn County), two species associated with buckeye, false indigo (*Amorpha californica*) and redbud (*Cercis occidentalis*), are represented in the fossil leaf flora dating from the Miocene period (collections in the Crater Rock Museum: redbud in the Conde Creek Formation (Neilson collection) and Roxy Ann Formation (Callahan collection with seeds and pods in addition to the leaves). Orr and Orr (1999) reported this same flora extending north to The Dalles and along the Columbia river during the Miocene. The Dalles flora included *Cercis 'occidentalis,' Amorpha 'fruticosa'* and *Ulmus*. *Amorpha* has since re-naturalized along the Columbia River (Glad and Halse 1993) and *Ulmus* became extinct. [Single quotes are used around names of plants when fossil material is indistinguishable from modern plants.]



Native distribution of California buckeye. Map adapted from Little (1976).

At the Crater Rock Museum in Central Point, Doug Foster and I have been researching and reconstructing the paleofloras of Jackson County, using the museum's extensive petrified wood collection along with leaf and seed impressions. Three distinct periods of preservation include the Miocene (5 to 25 million years ago), the Oligocene (25 to 35 million years ago), and the Eocene (35 to 55 million years ago). California buckeye petrified wood is linked to the Miocene by the Trout Creek Formation in Malheur and Harney counties (Rice Museum petrified wood specimen #M4237) and the Cove Creek Oligocene Bridge Creek Flora in Wheeler and Grant counties (Manchester and Meyer 1997). The Miocene exhibited a much more diverse flora than is known today, containing many more representatives from the California Floristic Province than does the present flora. Southern taxa present in both extant and fossil floras include northern California black walnut (*Juglans californica* var. *hindsii*), false indigo (*Amorpha*), and redbud (*Cercis*), although they are rare in the Rogue Valley today. Also represented the Rogue Valley Paleoflora are redwood (*Sequoia*), dawn redwood (*Metasequoia*), California bay laurel (*Umbellularia*), Western sycamore (*Platanus 'racemosa'*) and interior live oak (*Quercus 'wislizeni'*) are well represented as petrified wood as well as leaf and seed impressions. The estimate of 20 to 30 million years ago needs some refinement because the fossil floras of Jackson County are dated by comparison with similar floras. Radiometric dating, which gives a more accurate timescale, has not been done on many of the County's fossil strata.

The late Miocene conifer forest of the Columbia Plateau-Cascade region has also been highly modified since 10 million years ago. Perhaps the area floristically most related to this vegetation is the Oregon part of the Klamath Range and adjacent areas (also known as the Siskiyou Mountains). In this region, most of the late Miocene conifer species have survived, including some of the associated ligneous dicotyledons (Wolfe 1969). Thus, the Klamath Mountains became a refugia for many species that perished elsewhere; it is possible that California buckeye is a Tertiary relict.

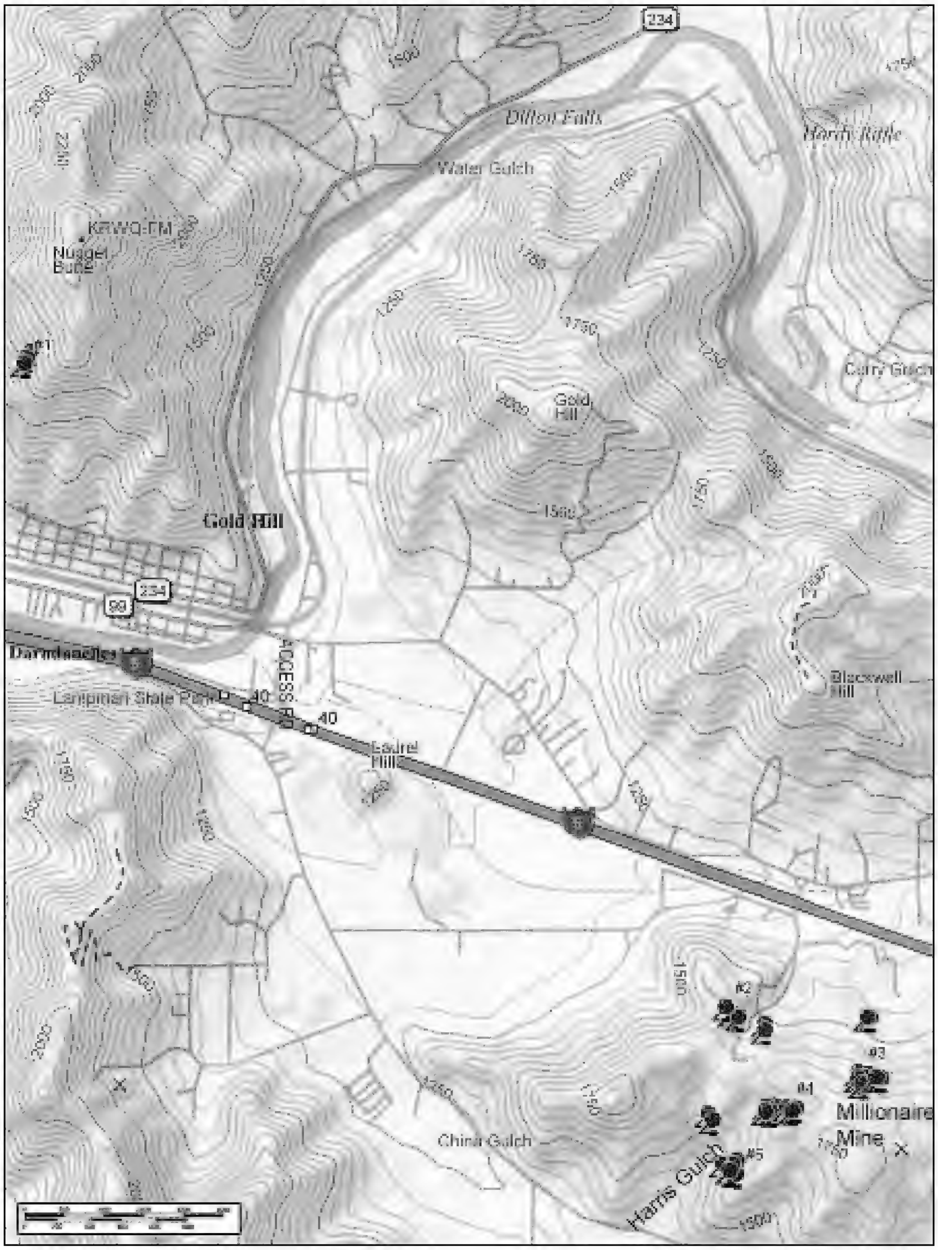
Near the end of the Miocene the climate began to fluctuate, becoming colder in the Pliocene to early Pleistocene. About 10 to

2 or 3 million years ago the flora became depauperate compared to the warmer Miocene. The Northwest flora still contained some broad-leaf deciduous elements, including *Aesculus*. By the early Pleistocene, however, ancient broad-leaf species were almost extinct in the Northwest (Wolfe 1969). The onset of a definite summer dry climate with colder winter temperatures in the Pacific Northwest would account for the extinction of many lineages about 1.8 million years ago (Bishop 2003). This cooling event plunged the planet into a series of ice ages that lasted until about 10,000 years ago, decimating most of the tender plants and creating the modern flora we know today. Fan palms (*Sabalites*), avocado (*Persea*), dawn redwood (*Metasequoia*), euptelea (*Euptelea*), sweetgum (*Liquidambar*), hickory (*Carya*), bald cypress (*Taxodium*), and hophornbeam (*Ostrya*) all perished during the series of Pleistocene glacial events.

The close of the Pleistocene led to a series of warming periods collectively known as the Holocene. This warming trend enabled plants to migrate northward while higher temperatures diminished elevation barriers. California buckeye may have migrated north with its associates of the chaparral community about 8,000 to 5,000 years ago, the warmest part of the Holocene (Hansen 1955). The gap from the uppermost Sacramento River (California buckeye's northernmost California station) to Oregon is relatively small (John Sawyer, pers. comm.). Daubenmire (1969) links the two categories of chaparral vegetation (scrub and woodland) extending from the margin of the great valley in California in fragmentary fashion into southern Oregon (principally the upper Rogue River valley, but with a trace of chaparral as far north to the Umpqua River valley). Wedgeleaf ceanothus (*Ceanothus cuneatus*) extends north to the southern Willamette Valley. Chaparral in southwestern Oregon is floristically closely related to that of California, with many species common to both areas or represented by closely related species or subspecies. The distribution of California buckeye is closely tied to chaparral that has its northernmost North American outpost in the Rogue Valley (Detling 1961). After the California chaparral communities crossed the altitude and ecological barriers of the Siskiyou Summit, cooler and moister conditions returned about 2,500 years ago that favor conifer, madrone and oak woodland, keeping the chaparral mosaic in check. Today the chaparral communities are limited to the lower Rogue Valley and adjacent foothills on poor soils.

Associates from the California Floristic Province

Perhaps the best evidence supporting the premise that California buckeye is a relict species in Oregon is the local assemblage of other species also at the northern limits of their ranges. In Harris Gulch, California buckeye shares habitat with fourteen species representing the California floristic province, including *Calycanthus occidentalis*, *Amorpha californica*, *Cercis occidentalis*, and *Cornus sessilis*. The drier uplands support the largest population of *Pinus sabiniana* in southwest Oregon. Although not found in the same habitat as the buckeye, other California species in the vicinity include *Fritillaria eastwoodiae, Odontostomum hartwegii*, *Triteleia ixioides* ssp. *scabra*, *Allium sanbornii*, *Ptelea crenulata*, *Styrax officinalis* var. *redivivus, Chlorogalum angustifolium*, *Brodiaea californica* var. *californica*, *Brodiaea minor*, and *Dichelostemma volubile.* The northern-most populations of each of these taxa in California are



California buckeye sites in Oregon. Map prepared by Frank Callahan and Bob Korfhage.

in Shasta County, except for gray pine, which is represented by a single population on Cottonwood Mountain, just north of the Klamath River in Siskiyou County, and California false indigo, which extends as far north as southern Siskiyou and Modoc counties.

Mediterranean Climate

The climate in the Rogue Valley with its hot, dry summers and mild winters that lack severe low temperatures is classified as Zone 7, Gray Pine Belt (Brenzel 2001). The namesake indicator tree in this climatic zone, the native gray pine, occurs as a sparse population on the low ridges and valleys near Gold Hill. Oliver Matthews, an ardent tree explorer and contemporary of Morton Peck, was probably the first to document *Pinus sabiniana* at Rock Point near Gold Hill. (Peck (1961) erroneously listed this site as Josephine County). Gray pine is currently known from Jackson and Josephine counties.

Microclimate and Foothills Distributions

That the foothills are cooler in summer and warmer in winter than the valley bottoms explains differences in species distribution. California buckeye is almost exclusively a foothills species in California; there are no significant populations in the flat Sacramento or San Joaquin Valley basins (Griffin and Critchfield 1972, Little 1976, McMinn 1974). In the California cismontane region, it is also strictly confined to the Sierra Nevada foothills. This foothill distribution holds true in the Rogue and Bear Creek valleys in Oregon, as well, occurring in a band between 1300 and 1700 feet elevation. Distribution appears related to cold hardiness, and is most easily described by elevation limits. In southern Siskiyou County, California buckeye grows on sites below 3,000 feet elevation, while in the southern portion of its range, especially south of Bakersfield, it is found to 5,000 feet. At the western edge of its distribution, it grows in protected ravines and sheltered coastal bluffs. In the inner Coast Ranges, it is found in open grassland and broken woodlands.

The foothills distribution pattern is not unique to the California buckeye; a number of foothill species are absent from the Bear Creek valley floor (e.g., *Garrya fremontii*, *Viburnum ellipticum, Acer circinatum, Pinus attenuata, Rhamnus crocea, Cercis occidentalis, Ptelea crenulata, Styrax officinalis* var. *redivivus, Calycanthus occidentalis*, *Cornus nuttallii* and *C. sessilis*). Differences between foothill and basin floras are easily explained by microclimatic conditions: in summer, the basins are hot thermal troughs and in winter, they serve as cold air basins. Under these seasonal temperature extremes in the valley basins, sensitive species tend to be killed by drought in summer or by freezing temperatures during winter. For example, wedgeleaf ceanothus thrives on thermal slopes and in basins. In contrast, deerbrush (*Ceanothus integerrimus*) appears less tolerant of high summer temperatures, and its distribution is limited to the foothills. Precipitation is also an important difference between foothill and basin habitats. For example, total precipitation for the 2003 water year at the Medford airport (valley location) was 23.2 inches. In contrast, at the California buckeye (foothill) sites the 2003 water year measured 34.7 inches, a difference of 11.5 inches! Clearly, the foothill sites are considerably more mesic.

California buckeye seeds are a shiny mahogany brown. Photo by Cindy Roché.

However, a few old California buckeye trees in cultivation can be used to gauge its performance and hardiness on the valley floor. Here it thrives in cultivation and, with summer irrigation, its leaves remain green until late fall. (This appears to be the signature of a relict species that prospered in a past climatic regime of moist summer climate.) In the wild, it is damaged both by drought and subzero temperatures. Its reaction to both extremes is to die back and produce basal sprouts to reduce mass and ensure its perpetuity.

Sean Hogan reports a large California buckeye in Portland that measures over three feet in diameter on N. Boston Avenue, near Portland Street; it may be the largest individual in Oregon. In cultivation, it is an adaptable tree with pleasing stature, and unusual foliage, flowers and fruits. It has not been popular in cultivation and few nurseries stock it, but Oregon residents in areas of mild winters looking for something different could consider planting a California buckeye[1]. Be sure to plant seeds where you want the tree because they germinate with an aggressive taproot and resent transplanting.

Geology and Soils

The high diversity of plant species concentrated near Gold Hill seems to be related to complex geologic conditions that interplay on these sites. The sites range only about 1,000 feet in elevation (from slightly more than 1,000 feet at the Rogue River to the top of Gold Hill (a pyroxenite dome) at 2,158 feet and Blackwell Hill (a granodiorite pluton) at 2,142 feet. Soil parent materials derive from a complex of metavolcanics, metasediments (including limestone), and metaultramafics in linear intrusive bands, punctuated by granodioritic intrusives with accompanying quartz fault bands. The primary soils of the buckeye sites are

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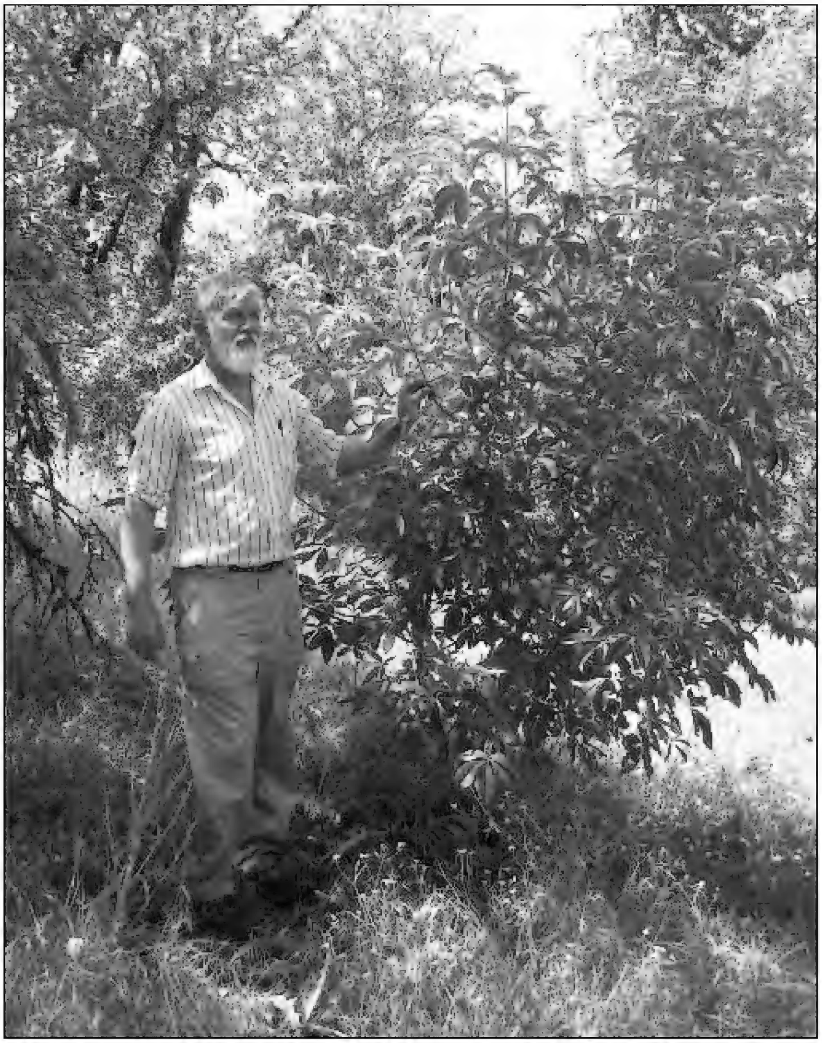
[1] Seeds available from Callahan Seeds, P.O. Box 5531, Central Point, OR 97502.

Vannoy silt loams, which are amenable to tilling during summer drought. Soil depth varies from rock outcrop to 10 feet, yielding plant communities that range from lichens and mosses to dense forests. California buckeye prefers a north-facing, mesic, open site and is seldom found in the Pacific madrone woodland. It shares habitat with Oregon white and California black oaks (*Quercus garryana, Q. kelloggii*), plume tree (*Cercocarpus betuloides* var. *macrourus*), gray, ponderosa and sugar pine (*Pinus sabiniana, P. ponderosa, P. lambertiana*), and Douglas fir (*Pseudotsuga menziesii*). Shrubs include whiteleaf manzanita (*Arctostaphylos viscida*), which grows to small tree stature, deer brush, wedgeleaf ceanothus, and Fremont's silk tassel (*Garrya fremontii*). Also of interest is a distinct population of Ida May brodiaea (*Dichelostemma idamaia*).



Author with resprouted California buckeye tree. Photo by Cindy Roché.

Human History

Why, if California buckeye has been in southern Oregon for 20 million years, was it not discovered until 1970? The site of Oregon's California buckeye populations was not a benign region for botanical explorers, for a variety of reasons. The word poison oak was always spoken with exclamation in these hills – best crop in the county, as old-timers would put it! Another word was gold – mining claims were fiercely protected and anyone viewed as a potential claim-jumper could meet harsh treatment. Moonshiners stationed themselves in hidden canyons to thwart discovery from revenuers, where they burnt the smokeless moonshine wood (manzanita) and sold whiskey to miners and other local contacts. Poachers hunted meat (rabbit and deer) for themselves and the miners. The Millionaire Mine with the Johnson shaft was the largest mine operation and provided jobs for about a dozen families. The operation was shut down after the paymaster absconded with the payroll, fleeing to Seattle, favoring a number of brothels on his way, before he was caught and later hanged. The Millionaire Mine never reopened (John Mardon, pers. comm.). Its historical signature includes large tailing piles, a few naturalized plants (*Iris, Vinca major*), and the cabins composting to the soil. Things remained quiet from the late 1930s through the early 1970s when some of the land was sold and firewood cutting began. Major logging of the hills from the 1970's until the late 1990's removed most of the conifers over 14 inches in diameter, leaving few remaining trees. Douglas fir survived only in hidden canyons. Gone were the few stands of gray pine on the ridgetops and sugar pine in the protected drainages. Incense cedar was rare and occurred only on the ultramafic barrens. Since then, conifer reproduction has been slow because most of the adult seed trees were removed. Pacific madrone and California buckeye have recovered by stump sprouting. Whiteleaf manzanita lacks this trait, and its seedbank in the soil awaits the next fire to produce seedlings. The last major fire was in 1927.

All the exploitation of former years was eclipsed by the abuse that occurred in 2004. A neighbor purchased a total of 100 acres of the old Mitchell Ranch and introduced cattle. The cattle created a virtual desert within one year! The property was so overgrazed that the *Cercocarpus* are all girdled and dying. Yellow starthistle (*Centaurea solstitialis*) has invaded; other noxious weeds and exotic grasses were brought in with contaminated hay.

Conservation Needs

In the 166 years since its entry into the botanical records, California buckeye has disappeared across much of its range. It is defenseless against the onslaught of human trespass that converts its foothills habitat into subdivisions and vineyards. In particular, the California wine industry is fueling mass destruction of native plants in the chaparral types. It is fortunate that buckeye readily resprouts; otherwise it might have been doomed in Oregon by firewood cutting. Sound land-use zoning laws could have prevented the recent grazing damage. Jackson County has a long history of county commissioners who favored cattle and timber interests; this has severely compromised any protection or conservation of special ecosystems. Jackson County lists most rural properties under exclusive farm use (EFU) or small woodlot. A zoning of open space or watershed offers better protection against activities that threaten buckeye habitat, e.g., livestock grazing, subdivision, land clearing and housing developments. A recent ownership change of Hidden Valley Ranch, which supports the largest populations of California buckeye, is not good news for this species. A development consortium unveiled plans for a major subdivision with 300 homes in private settings, termed the Millionaire Estates (Mann 2005). The planned development is a destination resort for the rich and famous, complete with private golf course, horse stables and equestrian trails, swimming pools, tennis courts, car museum and other amenities.

The bottom line is that there is no protection for any of these special ecosystems unless the public is made aware of them, and specific action taken to implement conservation measures protecting them. It was fortunate that this ecosystem was in a botanist's backyard or it might have been missed. What's in your backyard?

Acknowledgments

I would like to thank the following individuals for their contributions to this article: Dr. Frank A. Lang for his advice and suggestions of research articles, geologists Mary Donato and Ellen Bishop for reviews and criticism, John Sawyer and Bob Thorne for comments in updating information, and Rhoda Love for review and criticism. Doug Foster works with me in maintaining the petrified wood and fossil collections at the Crater Rock Museum. The late John Mardon shared the history of the Millionaire Mine. Bob Korfhage and Cindy Roché photographed the buckeye and prepared a map of the Oregon distribution.

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Frank Callahan, a member of the Siskiyou Chapter of NPSO, has reported over two dozen range extensions of California plants in Oregon. He has botanized extensively in Mexico. A writer and photographer, he wrote the *Calochortus* chapter for *Bulbs of North America* published by Timber Press, furnishing some of the photographs. He described two new species of *Calochortus*, *C. syntrophus* and *C. coxii*, published in *Herbertia* and *Phytologia*, respectively, and is presently working on two additional new species. He is a leading nominator of National Champion Trees, having reported the largest individual for the species in more than 60 species. He filmed botanical documentaries with Martha Stewart (Martha Stewart Living), Ed Bagley Jr. (Big Foot County), and "American Forest–National Champion Trees" for PBS. He works as a private consultant field botanist for the Forest Service and BLM and manages a business, Callahan Seeds, which markets tree and shrub seeds globally. He is also the current president of Crater Rock Museum in Central Point, Oregon.

Botanizing Western Oregon In 1841 – The Wilkes Inland Expedition

Mariana D. Bornholdt
133 La Placita Circle, Santa Fe, New Mexico 87505

In the decades following the transcontinental trek of Meriwether Lewis and William Clark (1805-6), the Pacific Northwest was still dominated by Great Britain. Although American hunters, trappers, missionaries, and settlers had trickled in, Hudson's Bay Company forts, farms, and trading posts were strategically located along the rivers that served as major avenues of travel and commerce. Great Britain had also sent 120 Canadian settlers and their families south of the Columbia River, hoping to forestall an American takeover. Many of these *voyageurs* settled with their Indian wives in the upper Willamette Valley in a place known today as French Prairie. The War of 1812 against Great Britain (whose ships had been attacking US merchant ships) ended with the Treaty of Ghent, which provided for joint occupancy of the Pacific Northwest by the US and Great Britain. Both nations sought to diminish the claims of the other in this region.

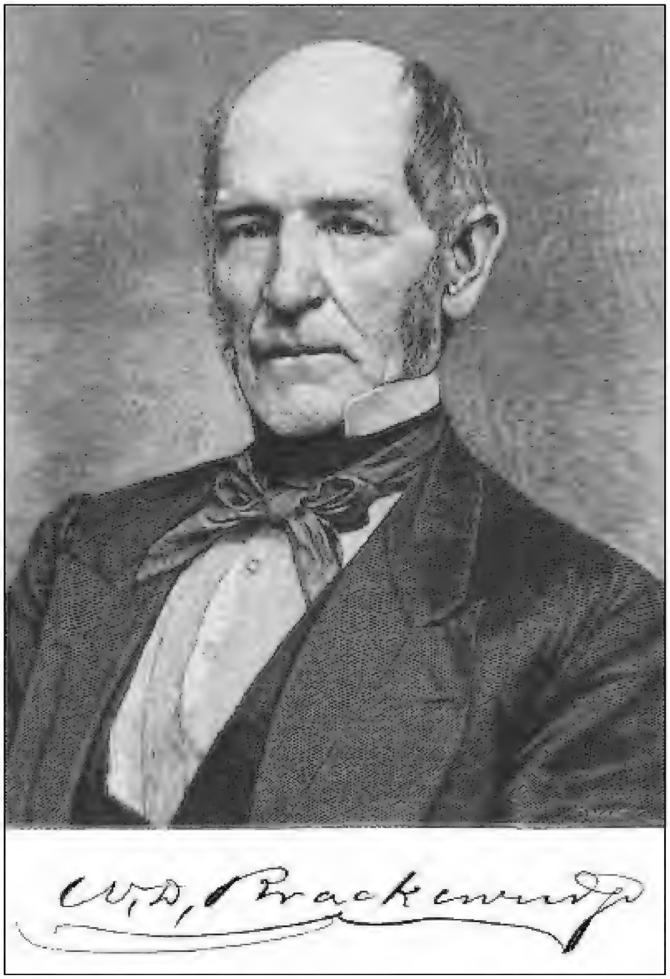
Fueled by a strong spirit of nationalism, these territorial disputes, along with the need for maps for additional fishing zones in the Southern Hemisphere and Pacific Ocean and trade with East Asian and Mediterranean countries, propelled the US need for global exploration. American merchant ships sailed at great risk, as piracy was rampant on the high seas. The United States Navy was created by an act of Congress on April 30, 1798, specifically to deal with piracy.

The global exploration authorized by Congress to address these concerns was ten years in the making. First proposed by President John Quincy Adams in 1825, it failed to win congressional funding. Public and business pressure continued to mount. On May 18, 1836, Congress passed an amendment to the Naval Appropriations Bill, authorizing the President to "send out a surveying and exploring expedition to the Pacific Ocean and the South seas" (South Pole), appropriating $300,000 for the expedition. This was a job ready-made for the young US Navy. However, it was difficult to find a leader of this expedition since it consisted of a squadron of sailing ships. Maritime steam propulsion had arrived, and high-ranking naval officers refused to be involved in an enterprise dependent upon winds, ocean currents, and out-dated technology. Hence, command finally devolved upon an obscure young lieutenant named Charles Wilkes (1798-1877).

The Great Exploring Expedition

Navy Secretary Mahlon Paulding issued the following order to Lieutenant Wilkes, commander of the expedition:

> *"Although the primary object of the Expedition is the promotion of the great interests of commerce and navigation, yet you will take all occasions not incompatible with the great purposes of your undertaking, to extend the bounds of science, and promote the acquisition of knowledge" (Smithsonian Institution, s.v.).*



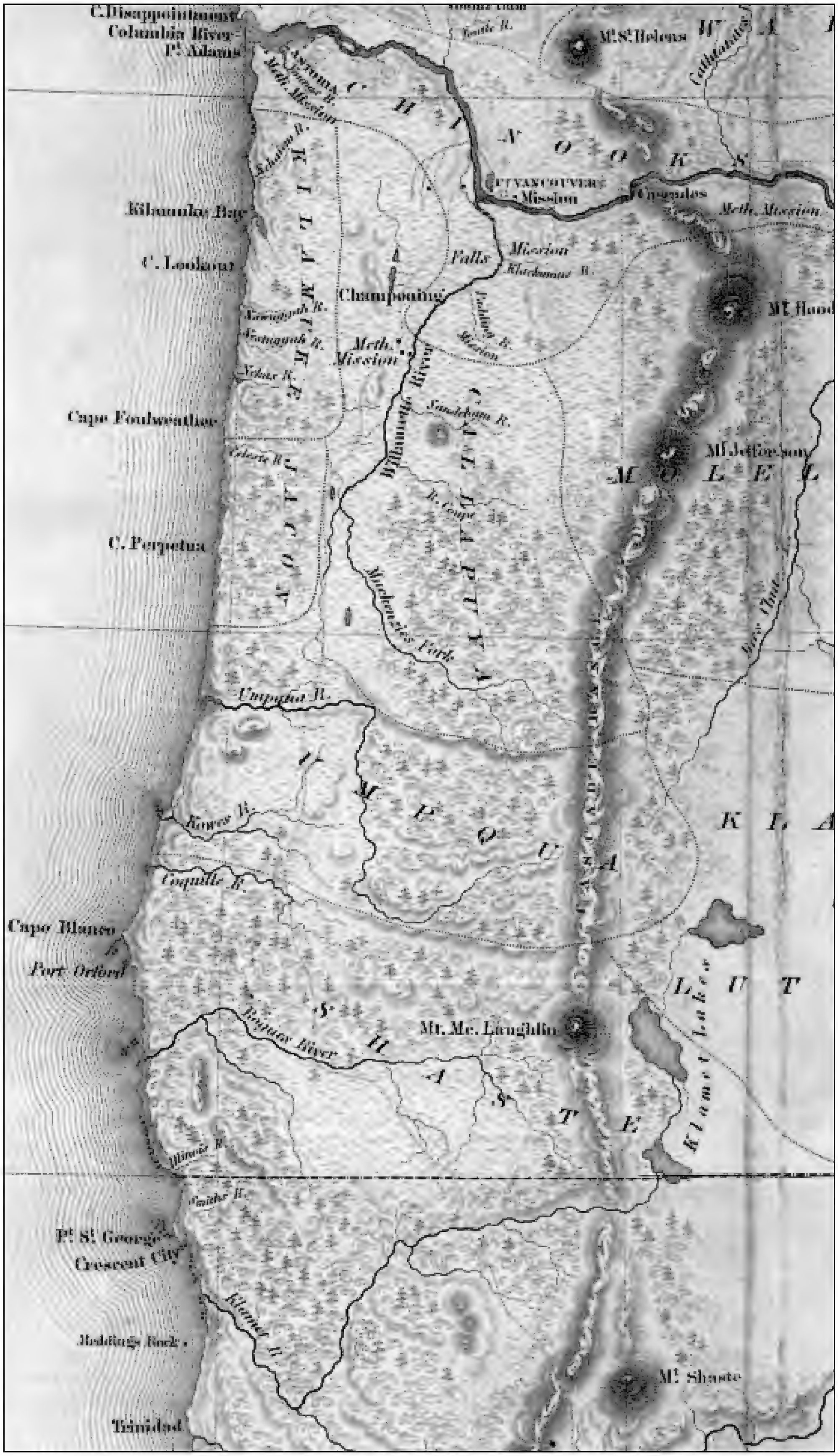
William Dunlop Brackenridge. (1810-1893) Frontispiece, *The Gardener's Monthly and Horticulturist: Devoted to Horticulture, Agriculture and Rural Affairs* 26:312 (December 1894).

Specifically, Wilkes' commission was to circumnavigate the globe, explore and map Antarctic and East Asia coastlines, visit and chart islands of the Pacific as well as the west coast of North America, and document inland features of western North America. Scientific observations and specimen collections were to be made at every landfall. An ambitious and patriotic Navy officer, Wilkes believed that he could fill all scientific positions with naval personnel, but when he found that he could not, he grudgingly included a few civilian "scientifics." Competition among prestigious individuals was keen for these posts. On August 18, 1838, amid a great public fanfare, a complement of 490 naval officers, sailors and "scientific" civilians aboard a squadron of six ships set sail from Norfolk, Virginia.

Exploration of Western North America

In the third year of the voyage, Wilkes' flagship, a three-masted sloop-of-war, the *Vincennes,* accompanied by the *Porpoise*, anchored as scheduled in Discovery Bay, near the entrance to Puget Sound, on April 29, 1841, later moving to Fort Nisqually (part of present-day Tacoma, Washington). Their assignment was to identify suitable locations for settlement, agriculture, and exploitation of natural resources beyond those visited by Lewis and Clark. Wilkes was also to develop information to support the American proposal, countered by the British, to extend the northern international boundary along the 49th parallel from the Rockies to the sea. Expedition personnel were assigned to three exploration parties: one went northeast over the Cascades to the headwaters of the Columbia; the second party charted Admiralty Inlet; while the third explored Hood Canal and charted Puget Sound above the Narrows between Tacoma and Gig Harbor. All expeditions were to note Hudson's Bay forts and trading centers, the national origin of settlers, as well as missionary activities. When reconvened at Fort Nisqually, the squadron sailed down the coast and entered the Columbia River, planning to survey and chart as far as "the Falls."

Two other ships, the *Peacock* and the *Flying Fish*, charting islands of the central and south Pacific, were late to the Columbia River rendezvous, limiting Wilkes' workforce. When they finally arrived on July 18, 1841, the *Peacock* foundered on the Columbia bar, losing all stores, specimens and scientific equipment. Miraculously, all hands aboard survived. In addition, difficulties in mapping and near-starvation among the parties charting the Puget Sound inlets pushed Wilkes' timetable perilously toward winter. This further delayed the final inland expedition



Excerpt from "Map of Upper California by the US Ex. Ex. and best authorities" showing Oregon Territory from Mt. St. Helens to Mt. Shasta. Drawn in 1846. Published in Wilkes, Charles, *Narrative of the United States Exploring Expedition during the Years 1838, 1839, 1840, 1841. Vol. 5. Philadelphia, PA: 1850.* American Memory Collection of the Library of Congress, courtesy L. Tom Perry Special Collections, Harold B. Lee Library, Brigham Young University, Provo, Utah.

south through Oregon into northern California, which was originally scheduled for more favorable summer weather conditions.

Preparations for the overland trip along the "Siskiyou trail" took almost a full month despite generous assistance from Dr. John McLoughlin, Chief Factor of the Hudson's Bay Company, and his staff. Food, medical supplies, scientific equipment, and horses were procured. Consultations were held concerning the route and possible encounters with Indian tribes, feared hostile. On 2 September 1841, Wilkes sent off his ships to chart the Oregon and northern California coastlines, detaching a land party to explore and map the "*terra incognita*" of the Willamette and Sacramento valleys. All parties were to meet at Buena Vista (San Francisco) in late October.

The Inland Expedition

Wilkes' original orders to Lieutenant Emmons, dated June 14, 1841, were written before the delayed arrival of the *Flying Fish* and the *Peacock*:

> *"...The route I have pointed out to you (along the Willamette trail, and across the rivers and mountains of Umpqua, Rogue and Klamath, to the valley of the Sacramento) is believed to be feasible, but as the country is unknown it may not be so... The information also expected from your party will be the names of tribes, numbers, manners, customs, habits, character, disposition and incidents that any occur to the party, as also the timber, kinds and quality of soil, climate, etc. The notes and journals should be full, and so as to be well understood by others without the necessity of explanation..."* (Eberstadt and Sons 1941, 106).

Wilkes originally directed the party to rendezvous at the foot of Mt. Hood, but with precious time lost, he revised his instructions to Emmons on September 1, 1841:

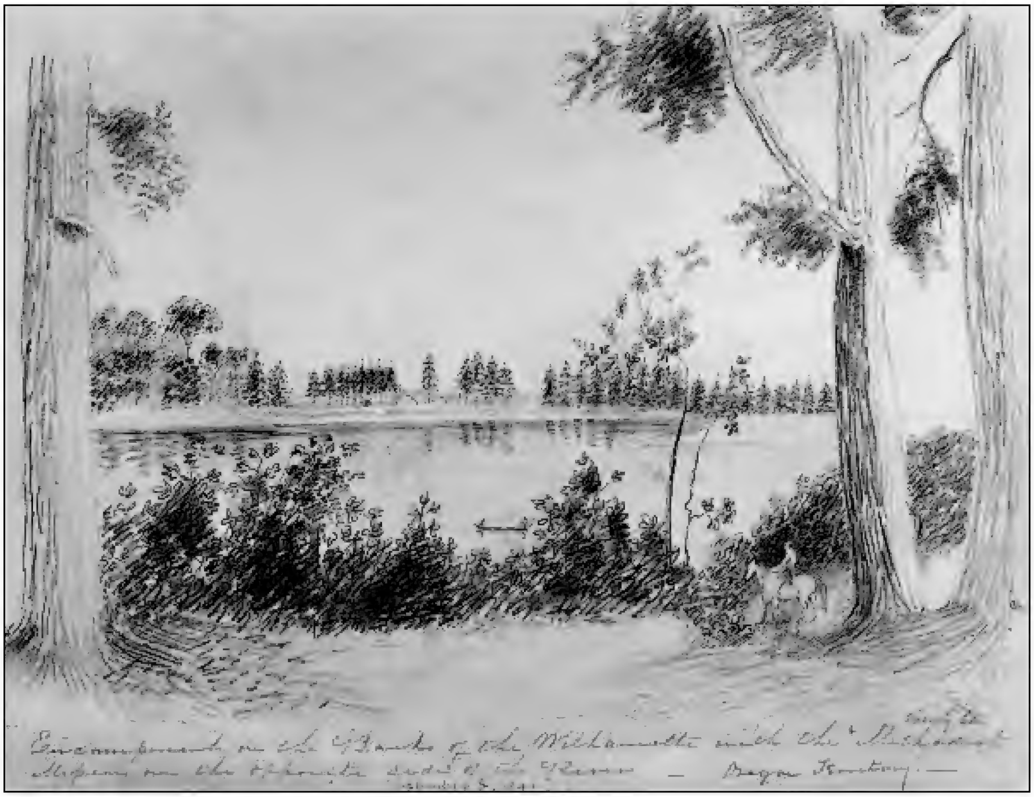
> [Instead of returning northward, go] *"south towards California, and if possible west of the Shaste Mountains, thence to strike the waters of the Sacramento, passing over the head waters of various streams that empty into the ocean, viz., the Umpqua, Klamet, and their branches... If you should fall upon the Sacramento, taking a more easterly route, you will, if you find it difficult to proceed with your horses, abandon them, and proceed in canoes down the river"* (Wilkes in Emmons 1841, 518).

Following Wilkes' instructions, Lieutenant Emmons' land party traced the Willamette Valley along the Willamette River to the Rogue River, went southeast over the Siskiyou Mountains into the Klamath basin to the headwaters of the Sacramento River, then followed the Sacramento and the San Joaquin rivers south through the delta to San Jose, a path roughly paralleled today by Amtrak's daily train, the *Coast Starlight.*

With George Foster Emmons as the leader, the inland party comprised a total of 39 individuals: 17 expedition members (including scientific personnel), 7 others recruited as guides and support personnel, as well as several families and individuals headed for California, who engaged the expedition as military escort. Henry Eld, Jr. served as geographer, Titian Ramsay Peale as naturalist (who also took notes on the flora), William Rich and William Dunlop Brackenridge as botanists, and Alfred T. Agate as artist.

Each member of the company observed and recorded the natural history of the region according to his own specialty. Journals were filled with maps, notes on topography, vegetation, and wildlife, estimates of the strength of British fortifications, as well as experiences with native people. According to previous agreement, Wilkes appropriated all the daily journals and records at the end of the voyage, and wrote the reports as though the observations were his own. He spent many years in all phases of publication of the reports, writing, publishing, negotiating, supervising specialists, and seeking funds from an indifferent Congress.

Passed Midshipman Henry Eld, the official map-maker for the expedition, produced 43 maps and 42 pencil sketches of the land between the Columbia River and the Sacramento Valley, providing a pictorial record of campsites and locations. The Eld maps are the first documents mapping the Willamette Valley and


Encampment on the Banks of the Wilhamette with the Methodist
Mission on the opposite side of the River — Oregon Territory.—

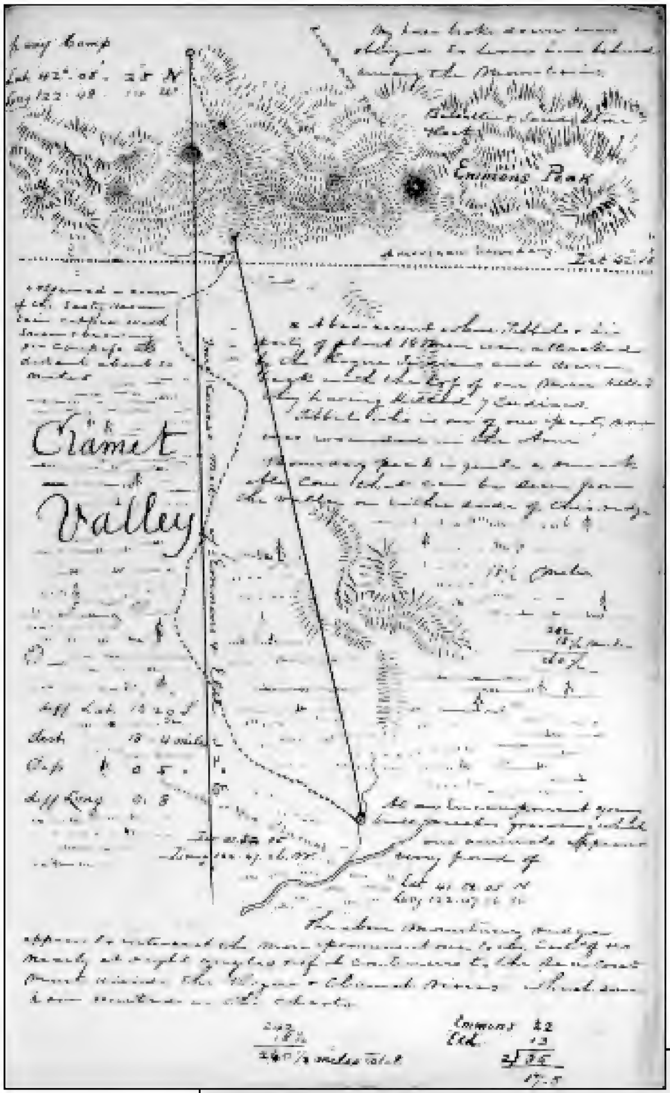
Encampment on the Banks of the Wilhamette with the Methodist Mission on the opposite bank of the River. 1841 pencil sketch by Henry Eld, Jr. Yale Collection of Western Americana, courtesy Beinecke Rare Book and Manuscript Library.

northern California. He appropriated the name "Mt. Shasty," which was the Hudson's Bay name for present-day Mt. McLoughlin, transferring it to a mountain previously known as "Mt. Simpson," "Pit (Pitt) Mountain," or "Mt. Jackson." Emmons' journal for the same date refers to his first view of the "Shaste or Pitt Mountain," seen in a very smoky atmosphere.

William Rich, a political appointee, was the expedition's Botanist, with William Brackenridge as "the Assistant Botanist/ Horticulturist." There appears to have been little interaction between the two men. Brackenridge faithfully kept a detailed day-by-day record of his experiences and plant collections, together with personal observations. Rich, on the other hand, evidently kept no records or notes, was sick during most of the trip, and is mentioned only in passing in others' journals. In fact, strenuous efforts were later made to expunge Rich from official records of the voyage, so great was contempt for his incompetence (Eyde 1986).

Brackenridge made nearly all of the numerous plant collections on the trek. A brawny Scotsman, he walked most of the route to facilitate collecting. Brackenridge was

> *"...a sixfooter with broad shoulders and broad forehead. He was rugged in speech and sometimes blunt and impetuous, but at heart he was kind and sensitive. He was ever a student of the classics equally well with science. We find him a strong mature man of thirty-one, undaunted by the hardships of a long horseback journey through hostile Indian country, and ranging the hills and valleys of present Siskiyou country. Apparently he was untouched by fever and ague which afflicted many members of the overland party"* (Maloney 1945, 323).



Map of the Clamet Valley. 1841 Pencil sketch by Henry Eld, Jr. Yale Collection of Western Americana, courtesy Beinecke Rare Book and Manuscript Library.

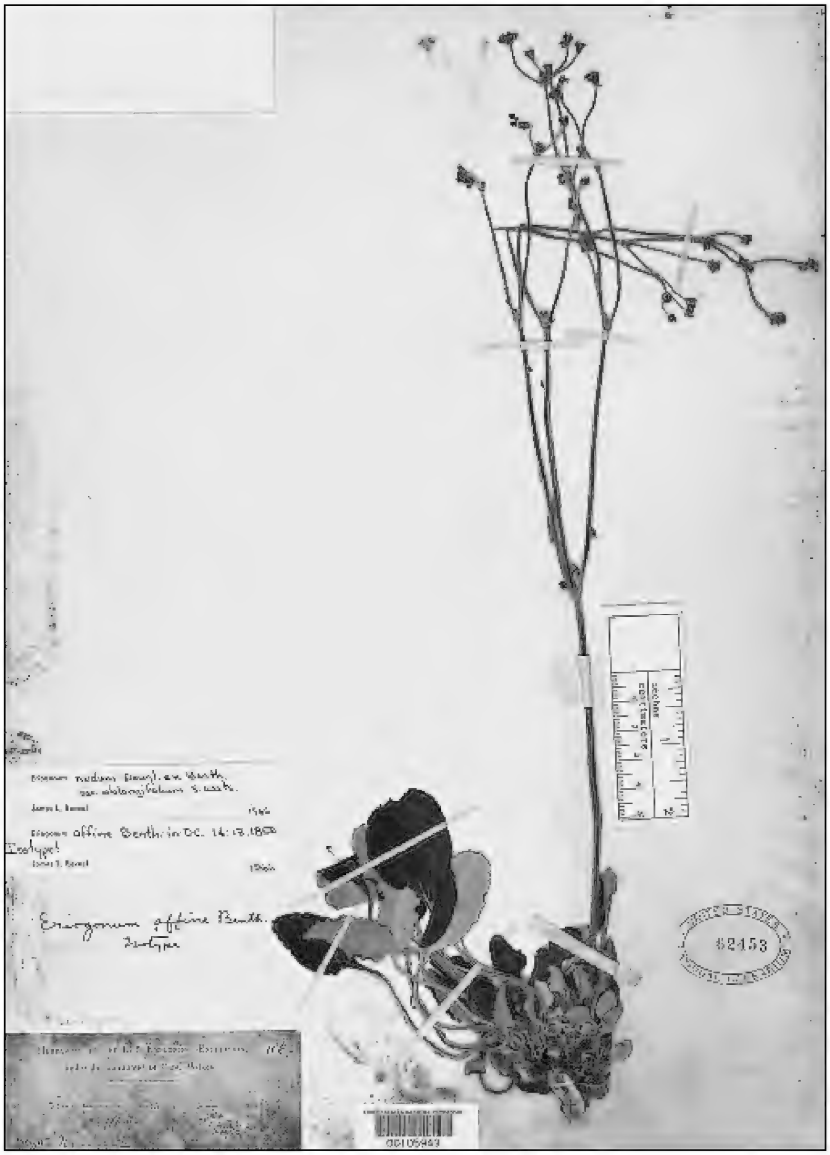
Crossing the Umpqua Mountains. 1841 Pencil sketch by Henry Eld, Jr. *Sketchbook No. 2.* Yale Collection of Western Americana, courtesy Beinecke Rare Book and Manuscript Library.

Brackenridge's narrative begins:

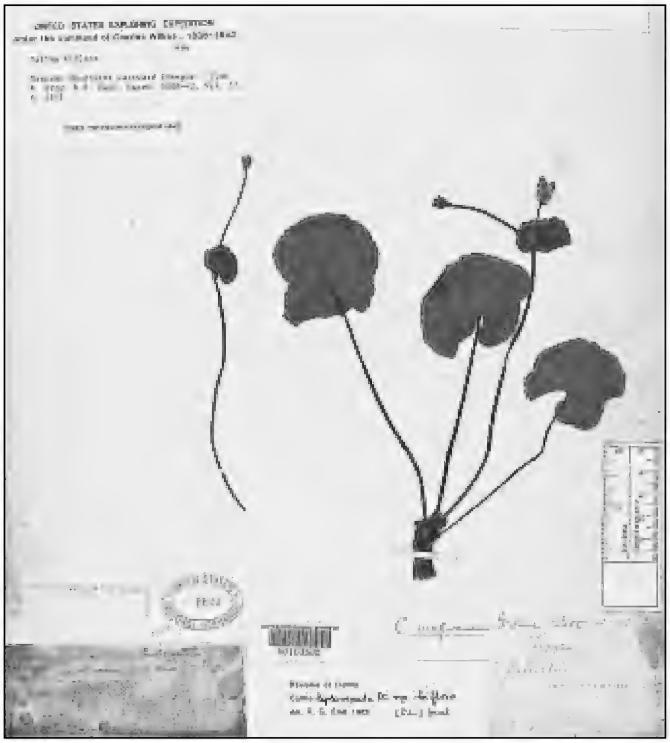
> [Sept.] *"2nd... In a canoe... After leaving the Columbia, the first 20 miles of the Willamette, the banks is covered with Willow, Alder & Dogwood, behind which rises spruce trees,* [first named *Abies douglasii*, now *Pseudotsuga menziesii*], *and as you proceed farther up toward the Falls, the same kind of brush wood line its banks, but behind this occasional patches of open prairie which support solitary Oaks, with scrub brush of the same are observed. I saw no Squat[t]ers or other dwelling Houses till we reached the Falls...*
>
> [Sept.] *"4th. Early this morning we found that we had come too on the farm of Mr. Thomas McKay* [a stepson of Dr. McLoughlin]. *On finding out who we were he kindly invited us to breakfast at his house, which was not far distant. Mr. McK possess a good Flour Mill, but for want of water during the greater part of the year is of little use to him. The party being still 15 Miles farther up the River, he provided us with Horses to ride and a cart to carry our luggage, which was accepted, but as I wished to pick up a few plants by the way I walked on in Co. with S. Stearns, & reached the encampment which was on the opposite side of the River from the Mission Station* [now known as Mission Bottom] *at about 3 in the Afternoon. During my walk from Champooi to Mission Station, the country was level, and the soil appeared good, of a deep black Loamy nature. Hazel bushes & a goodly number of fine Oaks was the prevailing vegetation. On this district a considerable number of Canadian Frenchmen have settled down. Cultivating small farms from 10 to 40 acres in extent...*
>
> [Sept.] *"5th and 6th. I spent the most of these two days in collecting Seeds, & viewing the nature of the country in our vicinity, and in both of these I was perfectly well satisfied. The season for flowering being now past, the Seeds were in good condition, particularly Annuals:* Oenotheras, Gilias, Escholtzia California, Clintonia, Mimulis, *and several other good plants I secured. Of soil and land the whole within 5 miles of our Camp, could be brought in as good farming ground. The major part of the land in the Willamette is a deep black heavy Loam and very difficult to break up after the Summer Droughts set in. This character will gradually give way to cultivation...*
>
> *"Sept. 16 ...we reached Elk river...the party encamped till a party consisting of Messrs Emmons, Agate, & Stearns with a Canadian as guide paid a visit to Fort Um[p]qua, belonging to the H. B. Company, which was said to be distant 12 miles. Mr. R.[Rich] and myself examined our collections, and in the afternoon walked out, where we found a species of Oak, new to us...*
>
> [Sept.] "*17th Busy collecting seeds and plants... Atmosphere today very dense...*
>
> [Sept.] "*23 Mr. Peales* [sic] *notebook and several other things belonging to him having got lost yesterday, a party went back in search of them, which detained the main party in Camp all day; in the vicinity a good many seeds were collected: of Plants we found a bulb in habit of an* Anthericum *which the natives of California made use of in place of Soap.* Lilium *sp: with large Orange flowers.* Pyrola *sp: with glaucous leaves. Also a* Nuttallia *which I though different from the one on the Willamett* [sic], *Day warm with sunshine towards eavening."* (Sperlin 1931)

As Brackenridge noted, Titian Ramsay Peale lost his journal, along with his clothing and equipment, in a mishap on the trail on September 23. He recovered only one of his boots and his *camera lucida* (a device which projects a scene onto a piece of paper so that it can be traced, a time saver for a landscape artist in the field). The following day, Peale began his journal anew:

> "*Friday Sept.24th Started soon after sunrise, crossed rolling prairie land bordered by round hills covered by Lamberts & long-leafed pines, yews, spruce, cedar and* Arbutus *trees, with a thick undergroth (sic). Sat^{y} 25th... Started at 9 A.M. and*



Eriogonum affine Bentham, G. in Candolle, A.P. de, *Prodr.* 14:13. 1856. Isotype (Polygonaceae). Collected by Brackenridge, W.D. US Exploring Expedition 1162. September, 1841, in Douglas County along the Umpqua River. United States National Herbarium Type Specimen Register. Courtesy of the Smithsonian Institution, Botany Section, Department of Systematic Biology.



Caltha malvacea Greene, E.L. *Pittonia* 4:75. 1899. Holotype (Ranunculaceae). Collected by Brackenridge, W. D. Wilkes Exploring Expedition 484. 1841, in Oregon, Cascade Range. (Current placement: *Caltha leptosepala* D.C. subsp. *biflora* (DC) Smit). United States National Herbarium Type Specimen Register. Courtesy of the Smithsonian Institution, Botany Section, Department of Systematic Biology.

> *continued our course over burned woods and small patches of prairie...to camp, arriv^g just at dark...the woods here consists of Lamberts and a long-leafed pine besides two species of oak. Tuesday Sept. 28th Soon after starting this morning Mess^rs Rich and Colvocoresses were both taken sick with fever...a small party remained with them as a guard... Collected a great variety of seeds; amongst which are two or three species of* Oenothera *and a new sp^s of* Nuttallia, *having purple flowers*" (Poesch 1961).

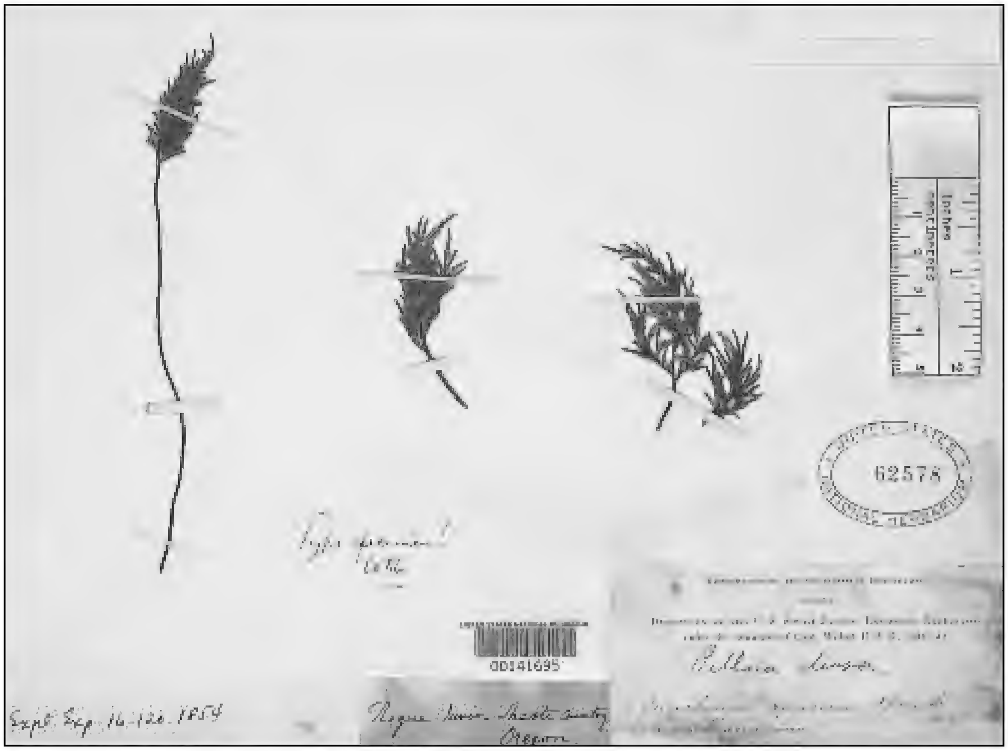
["Nuttalia" presents some problems as Brackenridge mentions two species, which are most probably *Mentzelia laevicaulis* (Hitchcock cites *Nuttalia parviflora* Greene, Leafl. 1:210, 1906) and *Oemleria cerasiformis* (Jepson cites *Osmaronia* for *Oemleria*; Hitchcock cites *Nuttalia davidiana* for *Osmaronia*).]

Brackenridge noted in his journal on September 29:

> "*We are now at the base of the Shaste* (Siskiyou) *mountains, which are in general considered the boundary line between Oregon & California Territories, though densely covered with brushy wood the ascent was very easy & we expected every step as we advanced, to have a Skirmish with the Indians, our exertions otherwise passed off easy...soon descended into an extensive valley where we encamped on the bank of a small stream for the night. The height of the range where we crossed I estimated at 1500 feet. In vegetation it is very poor...On the 29th* [of September 1841], *we crossed the boundary range which separates Oregon from Upper California. The greatest elevation of the range was found to be 2,000 feet. The ascent was steep and tedious, and every moment we expected to be attacked by hostile Indians... On arriving at the summit of the range, we obtained a view which more than repaid us for our trouble. The Shaste Mountains with their snowy peaks, were to be seen some fifty miles to the southward, swelling and soaring to the skies...*" (Sperlin 1931).

Peale observed the following on the evening of the same day:

> *"Wednesday Sept 29th... Passed the dreaded 'bloody pass' without difficulty...and after surmounting a high mountain ridge a view of Singular grandeur was spread before us. On our right the mnts were burning and sent up immense clouds of smoke. On our left with the snowy summits of Mount Chasty (Tchasty?) – extensive plaines were in front of us. In descending we had to cross rugged sandstone ridges covered with red cedar and Buckthorn bushes...we had a hot and thirsty ride of about 20 miles to the Tchasty river, near to which on a small branch we halted for the night...we found many curious plants and*



Onychium densum Brackenridge, W.D. in Wilkes, C. *US Exploring Expedition* 16:120. 1854. Holotype (Adiantaceae). Collected by Wilkes Exploring Expedition 1 1838-1842. Oregon. Current placement: *Aspidotis densa* (Brack.) Lellinger (Adiantaceae). United States National Herbarium Type Specimen Register. Courtesy of the Smithsonian Institution, Botany Section, Department of Systematic Biology.

Images of the following species collected by Brackenridge in Oregon on the 1841 Inland Expedition are currently in the Type Specimen Records at the US National Herbarium:

Byrum oreganum Sullivant. (Bryaceae) Isotype.
Caltha malvacea Greene. (Ranunculaceae) Holotype.
  Currently placed: *Caltha leptosepala* DC. subsp. *biflora* (DC) Smit. (Ranunculaceae)
Eriogonum affine Bentham. (Polygonaceae) Isotype.
Eriogonum confertiflorum Bentham. (Polygonaceae) Isotype.
Onychium densum Brackenridge. (Adiantaceae) Holotype. Currently placed: *Aspidotus densa* (Brack.) Lellinger (Adiantaceae)

In addition, the Type Specimen Records presently contain in an ongoing imaging project the following species collected by the 1841 Inland Expedition in California. Credit is given to the Wilkes Ex. Ex., but the collection was undoubtedly made by Brackenridge.

Eriogonum acetoselloides (Polygonaceae) Isotype.
Eriogonum trachygonum (Polygonaceae) Isotype
Eriogonum vimineum var. *eriocladon* (Polygonaceae) Isotype.
Darlingtonia californica Torrey (Sarraceniaceae) Isotype.

Brackenridge collected *Darlingtonia californica* near Castle Crags (on Mount Eddy) in northern California. John Torrey, who described the plant after Dr. W. G. Hulse, Frémont's botanist, brought him a more perfect specimen, published *Darlingtonia: Nov. Gen.* in 1853, writing that

> "[Brackenridge] *found it in a marsh, bordering a small tributary of the Upper Sacramento, a few miles south of Shasta Peak...and I take great pleasure in dedicating it to my highly esteemed friend Dr. William Darlington, of Westchester in Pennsylvania, whose valuable botanical works have contributed so largely to the scientific reputation of our country"* (Torrey 1853, 3).

Recent research concludes that details were misreported in Torrey's article and perpetuated by some subsequent writers (Freeman 1996). The popular account that the expedition was chased by Indians (purported to explain the less-than-ideal quality of the *Darlingtonia* specimen Brackenridge collected) first appears in print in *The Life of James Dwight Dana* by Daniel Coit Gilman, 1899, according to research by Alice Eastwood, botanist for the California Academy of Science. She points out that Brackenridge's journal does not refer to a chase by Indians on the day he collected *Darlingtonia* (Eastwood 1945).

> *gathered their seeds. Several species of* Oriogonum *were conspicuous"* (Poesch 1961).

The next day, Brackenridge took advantage of a day's halt:

> "*30th...While I went on an excursion three of the party were s[e]ized with the fever. Thermomiter* [sic] *today stood 90 in the Shade...*" (Sperlin 1931).

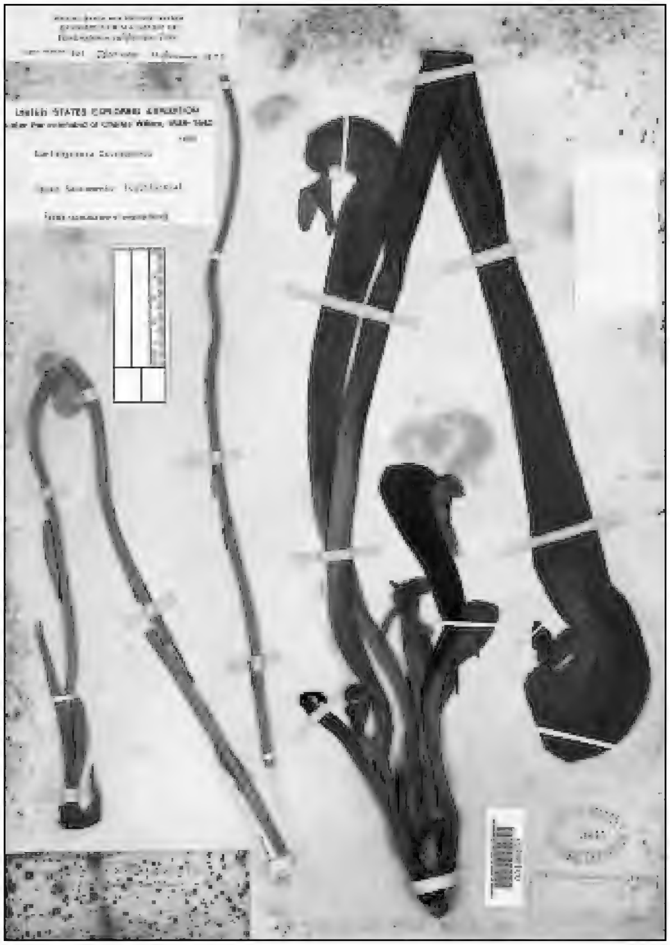
Peale also explored the vicinity of the encampment:

> *"Thursday Sept 30th Remained stationary today in consequence of the illness of Messrs Rich and Colvocoressis ...Mr. Agate and I wandered a few miles up the river...no timber, and an arid country. River...shores lived with a strong groth of Rushes... Washed clothes, cast balls, and put up seeds"* (Poesch 1961).

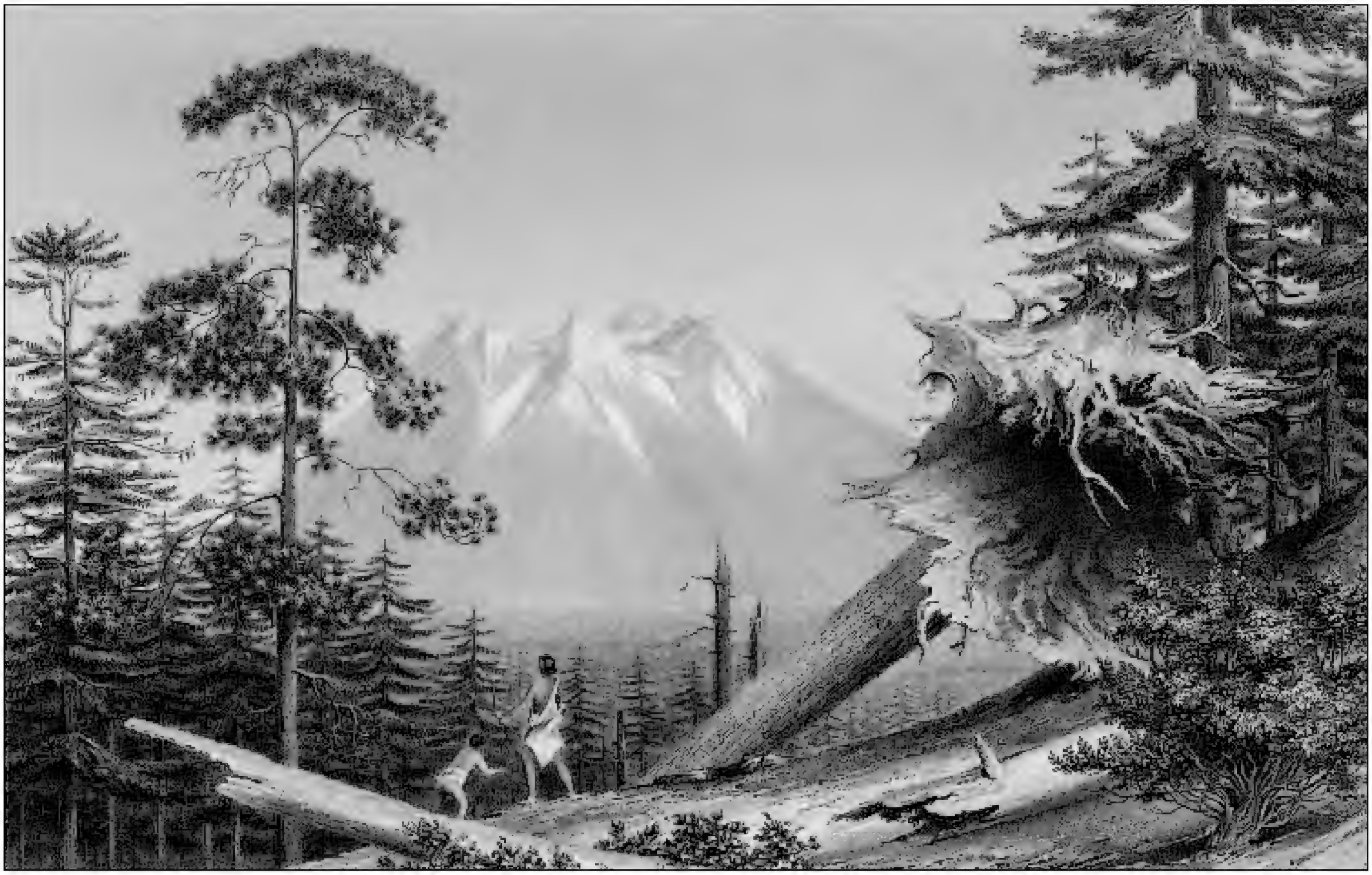
Leaving Oregon, Brackenridge laments:

> [Oct] "*3rd. Our route over mountains was too late in the season to have an opportunity of seeing much of the annual vegetation, but if we are to judge of the dried fragments of such as we observed, that this set of plants must be beautiful and varied"* (Sperlin 1931).

The route of the Inland Expedition followed closely that of David Douglas (1798-1834) as far as the Umpqua River. Brackenridge, however, was the first botanist to cross over the slopes of



Darlingtonia californica Torrey, J. *Smithsonian Contr. Knowl.* 6 (4): 5. 1854. Isotype (Sarraceniaceae). Collected by Brackenridge, W.D., September 1841, near Mount Eddy, upper Sacramento River, near Shasta Peak, California. Wilkes Exploring Expedition 1602. United States National Herbarium Type Specimen Register. Courtesy of the Smithsonian Institution, Botany Section, Department of Systematic Biology.



Shaste Peak. 1841. Steel engraving by unknown artist based on drawing by Alfred Thomas Agate. Earliest known picture of Mount Shasta. Published in Wilkes, C., *Narrative of the United States Exploring Expedition*, Vol. 5. 1845. Mount Shasta Companion, courtesy of the College of the Siskiyous Library.

the Siskiyou Mountains and to view Mount Shasta. More than 1700 plant specimens were collected on the trek, the majority by Brackenridge himself.

The party's travel from Fort Vancouver on the Columbia River to Yerba Buena (San Francisco), a distance of nearly 800 miles, took 58 days, including four days spent in camp. When traveling, they averaged about 13 miles per day on foot and on horseback. Wilkes noted their rendevous at Yerba Buena as follows:

> "...[at] *the harbor of St. Francisco, where we arrived on the 20th* [October 1841], *and found there the* Vincennes, *all well; and that they had nearly completed the work... The overland had not yet arrived, and the launch was despatched [sic] up the river to meet them On the 28th* [of October] *they returned"* (Wilkes 1842, 37).

The squadron immediately set sail and departed via the eastern Pacific for home. The *Vincennes* arrived in New York harbor on June 11, 1842, followed within a month by the other ships, nearly four years to the day after departure. However, members of the expedition did not receive a welcome comparable to their joyous and proud departure. The new administration received the news of their return coldly. Though Wilkes hastened to make a report to Congress within two weeks of arrival, acclaim came only from the public. Having duly requisitioned everyone's journals, Wilkes himself began to write up the journey and its discoveries. He soon became a popular hero through the newspapers, writers of the day, and his own efforts.

How did the scientific members of the Inland Expedition fare?

Titian Ramsay Peale (1799-1885) endured dark years after quarrels with Wilkes, but finally settled into government civil service. Alfred Agate (1812-1846) suffered poor health from the experience, and he died of consumption at the age of 34. Henry Eld (1814-1850) also died young, at the age of 36.

William Rich, (1800-1864), son of a US Ambassador to Spain, was a prominent Washington socialite. He had originally been appointed as Assistant Botanist to nationally-renowned Asa Gray, the Expedition's Botanist, but had been later cut from the scientific staff. Rich was re-engaged and promoted to Botanist when, at the last minute, Gray resigned his post to take an academic position. William Rich worked for four years on a write-up of the botany of the expedition, then gave up. Both his work and the man himself were judged inadequate. In 1845, Asa Gray advised J. D. Hooker:

> *"The botanist who accompanied the expedition is no doubt perfectly incompetent to the task, so greatly so that he has but a remote idea how incompetent he is"* (Gray 1973, 337).

Rich shortly thereafter resigned his situation and fled west, war with Mexico having begun. He returned to the Quartermaster Corps and later did a stint with the State Department in Mexico before disappearing from public life. John Torrey eventually rewrote the volume on botany, with the assistance of Asa Gray, who became involved in the Expedition once again. Upon examining Rich's manuscript in 1846, Torrey wrote to Gray:

> *"...could hardly believe it...Surely he could do nothing without aid...All of Rich's text is worthless"* (Rogers 1942, 181).

William Brackenridge (1810-1893) was charged with the responsibility of the living plant collection at the newly-established United States Botanical Garden. He also wrote the two-volume Expedition report on ferns (*Volume XVI - Botany - Filices*, 1854; *Volume XVI - Botany - Filices: Atlas*, 1856*)* (Haskell 1941) and for the balance of his long life conducted a successful nursery and landscape architecture business in Philadelphia.

What else did the Great Exploring Expedition achieve?

Even with the material losses when the *Peacock* foundered, a staggering number of items were brought back home, especially flora. McKelvey (1955) reports that ten thousand species and upwards of fifty thousand specimens of plants were collected. From Oregon, 1,218 plant species are cited; from California, 519. These formed the nucleus of the US National Herbarium where they are today. Nearly 100 live plants were brought home to the garden of the National Institute in Washington, DC, as well as hundreds of seeds. Brackenridge tended them with loving care.

Difficulties encountered in preparing the various Expedition scientific reports using only American botanical references soon brought recognition of the need for international cooperation in science, as well as for improved relations between exploration and taxonomy. As a result of the accomplishments of Wilkes' "scientifics," American natural science itself flourished. Proudly displayed in the Smithsonian and the US Botanical Garden, the collections made the desired mark on European heads of state and the world community. They remain an ongoing source of pride for Americans and an inspiration to youth. Moreover, achievements of the Wilkes Expedition "scientifics" were important catalysts for the emergence of the life science specialties. In particular, botany, the youngest scientific discipline of all, came into its own, springing from the ashes of William Rich's ignominy, well-nurtured by William Brackenridge, John Torrey, and Asa Gray, "the Father of American Botany."

Acknowledgments

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Mariana D. Bornholdt (MA, University of California at Berkeley; EdM, Oregon State University) taught Counseling Psychology at San Francisco State and Chico State colleges before retirement. Since moving to Oregon, she has taught literature and human services courses at Chemeketa and Central Oregon community colleges. An early member of the volunteer native plant task force, she is a long-time member of the Native Plant Society of Oregon and has served as president of the Willamette Valley chapter. Her special interest is fungi, and she is a member of the Toxicology Committee for the Oregon Mycological Society. A Master Gardener, she oversaw rehabilitation of a college farm in Ghana during her Peace Corps days. Her writings have appeared in numerous publications.

Our Threatened Timberlines:
The Plight of Whitebark Pine Ecosystems

Michael Murray
Crater Lake National Park, P.O. Box 7, Crater Lake, OR 97604

The hardy whitebark pine endures harsh timberline conditions where other trees often fail. Tipsoo Peak, Mt. Thielsen Wilderness. Photo by Michael Murray.

Living in quiet solitude on Oregon's highest peaks is the whitebark pine - a tree whose story is as stunning as its timberline landscape. Virtually ignored by lumbermen, foresters, and scientists for decades, whitebark pine is now gaining widespread attention. At high elevations where conditions are too harsh for other trees to survive, the enduring whitebark pine forms pure stands on sites that would otherwise be devoid of tree growth. Here, whitebark pine is considered the keystone species in a community of dependent organisms. Now, these systems are threatened by a non-native fungus causing white pine blister rust (*Cronartium ribicola*).

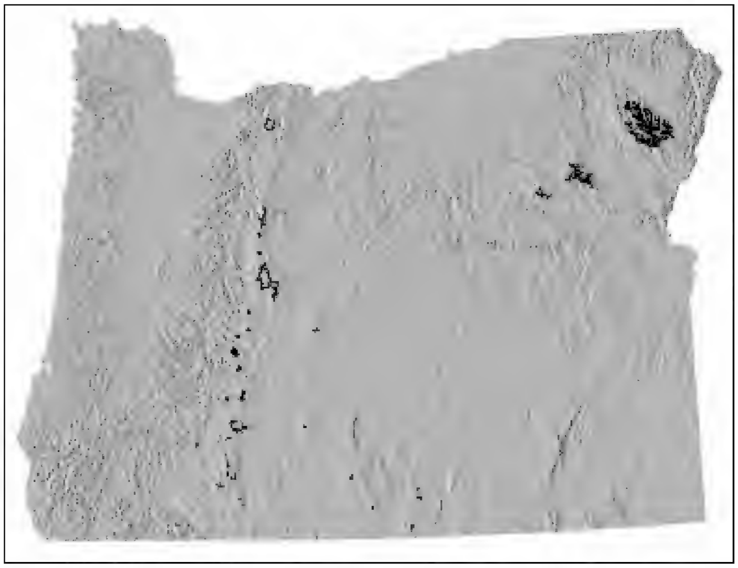
First described by George Engelmann (1863), whitebark pine has been acknowledged as the only North American representative of the stone pine subsection, *Cembrae*, within the larger subgenus of white pines—*Strobus,* 5-needle pines. Stone pines differ from other white pines by their large wingless seeds borne in cones that remain closed when mature. Not adapted for wind dissemination, seeds are distributed by a genus of specialized birds, nutcrackers (*Nucifera*), who pry cones open, extract the seeds, and store them in the ground in caches of one to fifteen seeds.

Natural History

Plant life at timberline is challenged by poorly developed soils, heavy snowfall, a short growing season, ice storms, and ferocious winds. In Oregon, subalpine soils are most commonly well-drained volcanic, sedimentary, or metamorphic, and in the Blue Mountains whitebark pine grow on calcareous substrates. Several physical traits permit whitebark pine to endure a harsh environment – flexible branchlets shed snow, stout stems, and well anchored root systems.

Apparently whitebark pine regeneration depends completely on Clark's nutcrackers who extract the pea-sized seeds from the cones and bury them for future use. Pine seeds are a major food source for the nutcrackers and a variety of other wildlife, big and small. The nutcracker's forgotten seed caches often germinate and develop into new trees: a true mutualistic relationship.

Although well-adapted to surviving at timberline, whitebark pine is not a strong competitor with other trees because of its relative shade intolerance and slow growth. Mountain hemlock (*Tsuga mertensiana*) and subalpine fir (*Abies lasiocarpa*) overtop whitebark pine on all but the most inhospitable peaks. Ironically, established whitebark pine contribute to the competitor's survival by sheltering fragile seedlings from the harsh elements. Common understory species of whitebark pine communities include smooth woodrush (*Luzula hitchcockii*), dwarf huckleberry (*Vaccinium scoparium*), Davidson's penstemon (*Penstemon davidsonii*), bottlebrush squirreltail (*Elymus elymoides*), Wheeler's bluegrass (*Poa wheeleri*), and Brainerd's sedge (*Carex brainerdii*).



Whitebark pine (*Pinus albicaulis*) is restricted to Oregon's highest mountain peaks. Map adapted from Kagan and others 1999.

Examination of pollen deposits in boggy soils and lakebeds reveals whitebark pine paleohistory. The oldest probable whitebark pine pollen (as well as pollen from spruce and fir) sampled from Yellowstone National Park was deposited during the Illinoian glacial period about 140,000 years ago (Baker 1981). (Pollen of all white pines is similar, and generally indistinguishable, thus probable species determinations are made from associated vegetation and other evidence.) In Oregon, it is hypothesized that whitebark pine is a more recent immigrant from both the northern Cascades and Idaho populations (Richardson and others 2002). Curiously, no evidence of whitebark pre-dating the Wisconsin ice age (which ended about 10-12,000 years ago) has been found in Oregon, although habitat was available prior to and during the glaciation. Whether the species is a late arrival here, or simply that earlier field evidence has not yet been discovered in Oregon, the range of whitebark pine has remained fairly static since continental glaciers receded about 10,000 years ago.

Timberline Communities

Whitebark pine is limited to high mountain environments of western North America, from the Coastal and Rocky Mountain Ranges of British Columbia and Alberta south through the Cascade and Sierra Nevada ranges. Small populations are scattered through the Klamath Mountains in California. To the east, Rocky Mountain whitebark pine extends south into Yellowstone National Park and Wyoming's Wind River Range, but does not reach Utah or Colorado. Many isolated populations in the Intermountain Region and Great Basin have only recently been documented. Numerous populations in Oregon have not been described in any detail or mapped.

Whitebark pine communities are found in four of Oregon's ecoregions: Blue Mountains, Klamath Mountains, Eastern Cascade Slopes and Foothills, and Cascades (Loy et al. 2001). Cascade Mountain populations occur sporadically along the volcanic spine stretching from Mt. Hood south to the Mountain Lakes Wilderness above Klamath Lake. To the east, stands persevere above junipered basins at Paulina Peak (Newberry Crater National Monument), the Gearhart Mountain Wilderness northeast of Bly, and the Strawberry, Elkhorn, and North Warner mountain ranges. The Wallowa Mountains also support extensive timberline forests of whitebark pine, including the alleged largest-known individual in the state (ODF 2002). Recently, Frank Lang documented a small collection of whitebark pine on Mt. Ashland (Lang 2003). It is the only known population from the Klamath-Siskiyou Region in Oregon. Fortunately, none of the trees would be destroyed under the preferred alternative in a planned expansion of the Mount Ashland ski area.

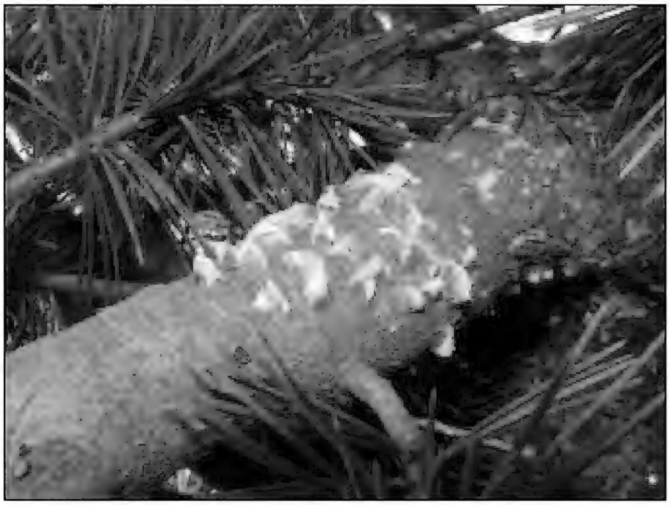
At two of the highest elevations, Mount Scott and Eagle Cap, whitebark pine barely survives in stunted clumps known as *krummholz*, a German word meaning "crooked wood" (Arno and Hammerly 1984). It's difficult to distinguish one tree from the other in these weather-battered patches of sprawling branches. Oregon's most accessible stands are located on Mt. Hood near Timberline Lodge, along the Rim Drive at Crater Lake National Park, Paulina Peak, and at the gondola summit of Mt. Howard in the Wallowa Mountains. Collectively, nearly 2.5 million people visit Oregon's whitebark pine stands annually.

The Human Influence: Decades of Quiet Decline

Restricted to remote lofty highlands, the hand of humanity has increasingly encroached on timberline habitats. Native Americans gathered the large nutritious seeds for food (Losensky 1990) and co-existed with the pines for centuries. Around 1860 high mountain hardrock mining operations began utilizing trees to fuel steam engines and wood stoves. Further damage started at the turn of the 20th century with bands of livestock trampling seedlings and overgrazing subalpine grasslands, which reduced the frequency of wildfires by removing grassy fuels (Skovlin and others 2001). In the early 1900s the federal government began a program of extinguishing all fires. As a consequence, the less fire-resistant fir and mountain hemlock began replacing whitebark pine. Nutcrackers, which are attracted to burned sites for caching seeds, had fewer options. Fire, however, is a complex force and can both benefit and damage whitebark pine. With unfavorable stand and fuel conditions, fire kills the trees, or leaves weakened survivors vulnerable to attack by native mountain pine beetles which tend to kill mature trees that are the best cone producers. And lastly, stands of whitebark pine have succumbed to a variety of road-building and development projects such as at Timberline Lodge, Crater Lake's Rim Drive, and several ski areas.

Above and beyond all other human-induced harm to whitebark pine populations has been the introduction of white pine blister rust, a non-native fungal affliction. It arrived on eastern white pine *(Pinus strobus*) seedlings grown in France and imported into Vancouver, British Columbia in 1910, despite warnings from European and American plant pathologists (Hadfield 2000, McDonald and Hoff 2001). By 1920 the epidemic had spread to western white pine (*P. monticola*) and sugar pine (*P. lambertiana*) in the southern Cascades. Diseased whitebark pine were first recorded in Oregon in the early 1930s near Mount Hood (Hadfield 2000). Blister rust completes part of its life-cycle on currant shrubs (*Ribes* spp.), thus removal of *Ribes* plants from the forests was attempted as a form of rust control. Detection and eradication efforts were directed primarily towards saving commercially-important western white and sugar pine, but they had only limited effectiveness and were abandoned in the 1960s.

The spread of the disease is a dynamic process that depends on clouds, fog, wind, and the alternate host—*Ribes*. As an airborne pathogen, spores travel great distances in humid air masses. Spores that connect with the undersides of *Ribes* leaves multiply and spread during cool wet summer days. By late summer, a new type of spore is formed on the leaves called a basidiospore. Breezes carry these to neighboring whitebark pine where the basidiospores enter needle stomata, grow hyphae, and start to spread internally through the phloem. The result is a swelling canker which can strangle the tree, killing all tissue above it. Usually, cankers are first noticed on branches, but they can also form on the main stem. The invading fungus fruits at the canker, producing more spores. It is only at this stage that disease can be confidently diagnosed, by the orange-yellow fungal tissue that blisters from the canker. Squirrels and other rodents often chew off the bark that covers cankers to obtain the sap that contains a high concentration of sugar. Aerial spores are disseminated from the blister fruits (see photo), remaining viable for weeks in the atmosphere while traveling hundreds of miles to distant *Ribes* where the cycle is repeated. After infection, mature trees can probably survive several years to decades, depending on size, number, and location of cankers. However, experts warn that only 0 to 5% of the whitebark pine population will survive the alien pathogen (Hoff and others 1994).


Fruiting structure of the blister rust fungus (*Cronartium ribicola*) emerges on branch of whitebark pine. As the tissue grows, the tree's living cells are damaged and a swollen canker often forms. Photo courtesy of National Park Service.

The magnitude of whitebark pine loss in Oregon is now being revealed (Table 1). In the Blue Mountains, disease-induced mortality varies greatly among locations (Schmitt and Scott 1998). Very high infection rates have been found at Mt. Howard in the Wallowas and the more remote Marble Point in the Elkhorn Range. Little to no infection was detected in the Wallowas at Sheep Creek and Mount Russell. The Strawberry Range population has also proven to be in good health. Apparently, all

Table 1. **Impacts of blister rust on Oregon's whitebark pine based on surveys between 1997 and 2004**

Oregon Location*	Infected Trees	DeadTrees	Reference
Mount Hood	28-83%	2-54%	J. Rice (pers. comm. 2004)
Badger Creek Wilderness (Mt. Hood NF)	49-90%	2-21%	J. Rice (pers. comm. 2004)
Blue Mountains	"none to severe"	–	Schmitt and Scott (1998)
Southern Cascades (north of Crater Lake)	46%	10%	Goheen and others (2002)
Crater Lake NP	0-20%	0-26%	Murray and Rasmussen (2003)
Mount Ashland	44% (4 of 9 ind.)	0%	Murray and Lang (unpubl. data 2004)

*Surveys conducted at a variety of sites for each location, except Mount Ashland – single site.

regions of the Oregon Cascades are besieged. Nearly half of the whitebark pine on the west side of Crater Lake National Park are dead or dying. There, blister rust is the most ubiquitous cause of mortality, outweighing all other biotic agents combined (Murray and Rasmussen 2003). The increasing number of dead trees has gained the attention of the visiting public, media, and scientific community.

Unless actions are taken, whitebark pine will continue to decline. With resistance levels estimated to be less than 5%, we can anticipate 95 to 99% mortality without management intervention. Because warmer environments favor the fungus, death rates are predicted to accelerate with regional warming trends. Thus, in the cooler, drier east part of Crater Lake National Park, where infection rates are less than 2%, pines will be at increasing risk.

A Lifeline To the Future

In the face of disheartening declines, public land stewards are heeding a call for action. With easy year-round access to Crater Lake's Rim, this National Park's whitebark pine ecosystems are perhaps the best studied in Oregon. Here, the Forest Service is joining the National Park Service in a conservation partnership. The most widely accepted strategy for retaining whitebark pine ecosystems is through facilitating natural selection of rust-resistance. Seedlings with enhanced resistance need to be produced and nurtured so they can become established and attain maturity. The process hinges on finding rust-resistant candidate trees occurring naturally (Sniezko and others 2004).

A bird-proof cage is installed over a cone cluster at Crater Lake's Rim Village while a Clark's nutcracker watches. Photo courtesy of National Park Service.

During the summer of 2003, I began Crater Lake National Park's first effort to select for the rust resistant gene pool. Rim Village was chosen as the selection site for several reasons: 1) disease had already killed many trees, 2) heavy visitation and high value to the public, 3) easy access, and 4) need to establish vegetation at a planned deconstruction project at the site. Ten healthy trees which exhibited few or no cankers were identified, measured, tagged, mapped, and photographed in anticipation of cone collection. One important obstacle remained, however, to ensure that the cones wouldn't be harvested by squirrels or nutcrackers before we could get them. To reserve our share, we placed mesh cages over branch tip cone clusters during mid-summer before cones ripening. For harvesting in late September, a boomlift (a.k.a, 'canopy crane'), proved to be a safer and more efficient method than climbing. The nutcrackers scolded us from nearby tree tops, as we stole what they considered their natural rights.

A sixty-foot boomlift is used to lift biologists to the cone-bearing branches of whitebark pine. Trees are being tested along the historic Promenade Walk for possible resistance to blister rust. Photo courtesy of National Park Service.

The whitebark pine seeds we collected are being prepared for planting at the Forest Service Dorena Tree Improvement Center near Cottage Grove. Seedlings will be exposed to the blister rust fungus and observed to determine survival during a five year period. Similar testing of whitebark pine in the Rocky Mountains indicated that between 1 and 44% of seedlings may survive the first several years – suggesting resistance (Hoff and others 2001).

Staff at Crater Lake National Park are also investigating other forces affecting the survival of whitebark pine, specifically fire and pine beetles. A fire history study is revealing the frequency and severity of subalpine fires among the three Cascade National Parks and neighboring National Forests. Although evidence of ancient fire (e.g. charcoal, fire scars, and post-fire age groups) has been found in most whitebark pine stands examined, no evidence of fire since the 1930s has been detected. When complete, this research can help direct the process of appropriately re-introducing fire to whitebark pine communities in the Cascades.

During the past several years, mountain pine beetle outbreaks have erupted leading to noticeable loss of whitebark pine in the southern Cascades. Consulting with the Deschutes National Forest, Crater Lake National Park is experimenting with a natural insect pheromone to ward off new attacks of this insect at Rim Village. Small packets infused with the pheromone are stapled to the bark of uninfected trees. The idea is that the pheromone signals to arriving beetles that the tree is already infested, causing them to pass it by. This is a costly and meticulous procedure, and is not practical to apply to hundreds of remaining acres throughout the Park. The Park's staff will continue to observe growth, infection, mortality and other tree dynamics with careful monitoring of permanent measuring plots at places such as Mt. Scott, The Watchman, and Llao Rock.

Resources for Further Information

Whitebark Pine Ecosystem Foundation – www.whitebarkfound.org

"Whitebark Pine Communities: Ecology and Restoration" (book, 2001) – islandpress.com or www.whitebarkfound.org

WBP Email Discussion List – www.srs.fs.usda.gov/list/usdafs.htm

"Crater Lake's Dying Forest" – Oregon Public Broadcasting: Oregon Field Guide episode #1405 (available through most public libraries)

"Made for Each Other: A symbiosis of birds and pines" (book, 1996, by Ronald Lanner) Oxford Univ. Press

Conclusion

The prognosis for Oregon's whitebark pine is bleak. With mortality outpacing the ability of the forests to self-replenish, the loss of these distinctive timberline communities will continue. As the keystone whitebark pine dwindles, we expect the web of dependent living organisms to suffer. Addressing the predicament, ecologists, geneticists, managers, and other concerned professionals are beginning to pool their expertise in a coordinated effort. Long-standing knowledge gained from protecting sugar and western white pines from blister rust is very useful. Identifying naturally occurring resistant trees is critical. Although blister rust appears to be a permanent element of Oregon, tenacious attention can ensure that healthy timberlines will persist.

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Dr. Murray has held several positions as a plant ecologist, including Oregon Natural Heritage Program, Wrangell-St. Elias National Park and Preserve in Alaska, and at the University of Idaho. His interests during the past fifteen years have been related to subalpine ecology. His education includes an MS from Humboldt State University for which he studied meadows in the Marble Mountain Wilderness, California, and a PhD from the University of Idaho, for which he researched whitebark pine fire ecology in the Rocky Mountains. He has served as terrestrial ecologist at Crater Lake National Park for almost four years, where he is responsible for research and management in the areas of wildlife, plants, and fire.

The Botanists at Crater Lake National Park

Elizabeth L. Horn
336 Marina Loop, West Yellowstone, MT 59758

Even before it became a National Park, Crater Lake attracted botanists and amateur plant enthusiasts. Early botanical explorations may have been inspired by William Gladstone Steel (1854-1934), who is often called the founder of Crater Lake National Park. As a teenager, Steel moved with his family from Kansas to Portland, Oregon. In 1894, he founded the Mazamas (an intrepid group of Portland mountaineers), who held their annual summer encampment at Crater Lake two years later. Steel invited numerous dignitaries and members of the scientific community, undoubtedly to enlist support for national park status for Crater Lake.

Among the invited groups was the National Forest Commission, responsible for making recommendations for legislation and management of public lands known as the Forest Reserves. Steele met them in Medford, Oregon, and traveled to Crater Lake with them to the 1896 Mazama meeting. The group included Gifford Pinchot (later to become first Chief of the Forest Service), Dr. Charles S. Sargent (Director of the Arnold Arboretum, Harvard University), and John Muir (champion of Yosemite which became a national park in 1890) (Applegate 1939). Even though inclement weather ended their camping trip after only one night, Pinchot was awed by the natural beauty and later helped Steel have Crater Lake designated a national park (S. Mark, pers. comm.).

Hart Merriam, Chief U.S. Biological Survey, in lead on horseback, followed by his assistant Vernon Bailey on horseback at Crater Lake in August 1896. Photo courtesy of Crater Lake National Park.

Early Exploration and Discoveries of New Species

Steel also invited a party from the Department of Agriculture, including Dr. Frederick V. Coville, Chief Botanist, and John B. Leiberg, who were investigating the plains vegetation of southeastern Oregon at the time. They reached the Crater Lake rim on August 13 from Fort Klamath via Anna (Annie) Creek (Coville 1897). Other members of this group were Dr. C. Hart Merriam, Chief of the U.S. Biological Survey, and his assistants Vernon Bailey, Edward Prebble, and Cleveland Allen (Applegate 1939). Merriam was working on his Life Zone classifications, which were later widely used throughout the mountainous West. Elmer I. Applegate, who had been corresponding with Coville, also joined the Crater Lake expedition (Lang 2003).

Coville's party camped on the rim of Crater Lake for a week, collecting plants from Llao Rock, the Watchman, Castle Crest, and Mount Scott as well as from Pole Bridge Creek, Vidae Cliff, and Red Cone. Coville even descended the trail down the caldera wall to a boat landing and visited Wizard Island (Coville 1897). Applegate and his brother Fred explored Mount Scott and provided Coville with a list of 22 specimens collected on the summit as well as additional species from the southern flank. Coville also received specimens from Mazama member/Oregon botanist Martin W. Gorman, who had made collecting trips to Crater Lake in the 1880s and again in 1896 (Bornholdt, pers. comm.).

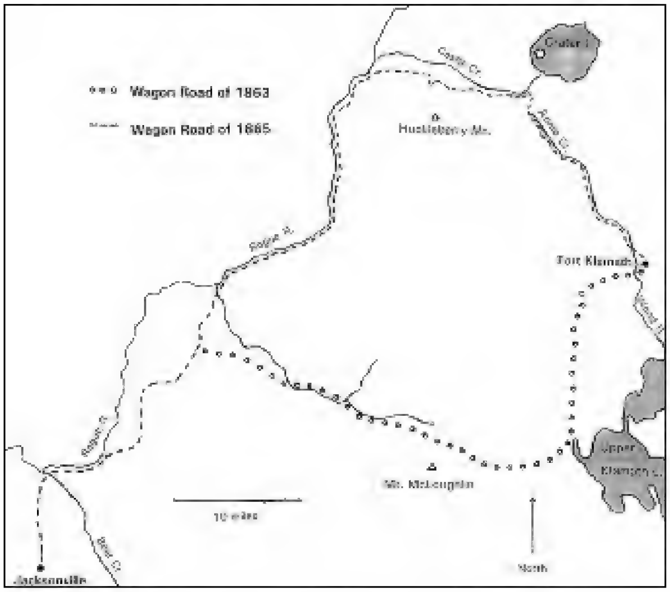
"The August Vegetation of Mount Mazama" (Coville 1897) included 175 species, five of which were newly described: pumice sandwort (*Arenaria pumicola*), Mount Mazama collomia (*Collomia mazama*), Gorman's buttercup (*Ranunculus gormanii*), Crater Lake currant (*Ribes erythrocarpum*), and grouseberry (*Vaccinium scoparium*) (Zika 2003). This doesn't count the paintbrush that Applegate collected on Mount Scott, which was originally identified as *Castilleja parviflora*, but was later named *C. applegatei* by M. L. Fernald of Harvard (Lang 2003).

Crater Lake currant (*Ribes erythrocarpum*) is a narrow endemic found only in a few Oregon counties and was first collected by Coville and Leiberg in 1896. It is an intermediate host for the blister rust on whitebark pine. Photo by Norm Jensen.

Coville's description reveals that generally, the vegetation has changed little since 1897:

> "*The vegetation about Crater Lake is primarily a great coniferous forest. Most of the mountain slopes are covered by a dense growth of trees….The forests are rather dry and have almost no underbrush, not enough to impede a foot-traveler. The commonest shrub is* Ribes erythrocarpum *and the most abundant plant* Juncus glabratum [Luzula hitchcockii]…. *On the gentle outer slopes of the crater occur long stretches of open land entirely devoid of trees and evidently covered until late in the spring with snow.*"

What has changed is public access and botanical collection. In the 1890s, botanical collection at Crater Lake was difficult: it took three days by wagon or horseback to travel from Ashland or Jacksonville, and about the same amount of time from Linkville [Klamath Falls] (Applegate 1939), via an 1865 military road that the Army built to carry supplies from the Rogue Valley to its post at Fort Klamath. This road followed much the same route as present-day Highway 62, staying above and south of Annie Creek and Castle Creek Canyons. From the military road, a tourist group from Jacksonville blazed a two-mile track from the Army road up Dutton Creek to the rim of Crater Lake (Mark 1997). After national park status was achieved in 1902, road improvements followed, as did the botanists. Now over 500,000 people visit the park every year, and plant collection may only be done by permit.



Map of wagon road route to Crater Lake in 1865. Map by Steve Mark, Crater Lake National Park.

Early Interpreters and a Park Flora

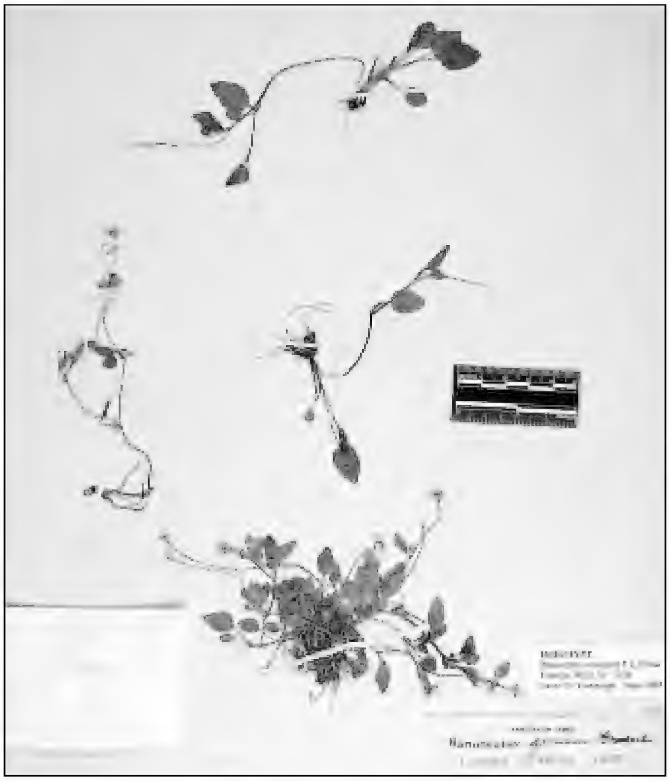
Three botanists who served on the park staff during the 1920s and 1930s, F. Lyle Wynd, Lincoln Constance, and Elmer Applegate, shaped the early botanical heritage of Crater Lake National Park, including the first floras of the Park, the concept of life zones, and informative articles published in *Nature Notes* (www.nps.gov/crla/notes).

F. Lyle Wynd high school graduation photograph, 1923, from Eugene High School Yearbook. Courtesy of Lane County Historical Museum, Eugene, OR.

F. Lyle Wynd

Wynd (1904-1987) spent his youth at Fort Klamath, only ten miles from the Park's boundary and became enthralled with Crater Lake. He was only 18 when he started working there as a ranger naturalist (Love 2002). Between 1923 and 1930 he collected extensively, and six years later he published the first "Flora of Crater Lake National Park" (Wynd 1936), which listed 433 species (Zika 2003). He personally collected all but three of the listed specimens, indicating his intimacy with the Park's flora. His specimens became part of the University of Oregon Herbarium (now housed at Oregon State University).

Wynd worked with C. Hart Merriam and was intrigued with the concept of Life Zones, which recognized that plant and animal species occur in latitudinal and altitudinal zones. Wynd went beyond finding and listing plants to describe how plants grouped together in communities; thus expanding botanical knowledge at CLNP to include habitats and vegetation patterns. He adapted Merriam's concept to describe three Life Zones in the Park. By increasing elevation these were 1) the Transition Zone, indicated by ponderosa pine (*Pinus ponderosa*) occurring mostly in the southeastern and northeastern corners of the park and interspersed with moist canyons, open slopes and meadows; 2) the Canadian Zone where forest cover is primarily lodgepole pine (*P. contorta*) and western white pine (*P. monticola*), from about 5,500 ft. elevation up to the Hudsonian Zone; and 3) the Hudsonian Zone, which includes forests of mountain hemlock (*Tsuga mertensiana*) and whitebark pine (*Pinus albicaulis*) on ridges (Wynd



Herbarium sheet of Wynd's holotype for *Ranunculus terrestris* collected at Red Blanket Creek, CLNP. Lyman Benson annotated the specimen as *Ranunulus gormanii* Greene in 1932.

1941). Within the Canadian Zone, diversity is contributed by environments such as streamsides, pumice flats (the Pumice Desert), and islands (Wizard Island and Phantom Ship). Comparable variation in the Hudsonian Zone is found in open pumice slopes around the rim, streamsides, talus slopes, and wet areas.

Lincoln Constance

Constance (1909-2001), a fellow student of Wynd under the enthusiastic direction of Louis F. Henderson at the University of Oregon (Love 2000), worked as a seasonal naturalist at Crater Lake in 1931 and 1932 (Ertter 2001). In addition to continuing work begun by Wynd, Constance wrote Nature Notes, in which he described several park wildflower displays, including those at Castle Crest. His whimsical bent was revealed by an article entitled "Flowers, Where the Scene-shifter–Nature–Is Always Busy" (Constance 1931). His more serious side was displayed when he advocated Crater Lake National Park as an ideal place for scientific study, arguing that the geologic beauty of the park is not more important than the "manifold fields for scientific investigation which it offers" (Constance 1932). While at Crater Lake Constance kept a few labeled specimens for visitors to identify and regularly led Rim caravans. Although one of his assignments while a seasonal employee was to compile a flora checklist, other chores prevented him from completing the list (S. Mark, pers. comm.).

Elmer I. Applegate

Applegate (1867-1949) worked as a Park Ranger (naturalist) from 1934 to 1939, starting when he was 67 years old! A native of southern Oregon, Applegate first visited Crater Lake as a ten-year-old boy. Since he began collecting and studying plants at an early age (Lang 2003), it is not surprising that he was involved with the 1896 Coville and Merriam expedition. That experience led to a job as field assistant for Coville as he collected in the Oregon Cascades (including Crater Lake) in the summers of 1897 and 1898. Applegate capably managed the pack animals as well as camping and plant collecting chores (Lang 2003). During the 1897 season, they discovered pumice grape fern or moonwort (*Botrychium pumicola*) (Applegate 1939). Applegate's checklist of the flora of Crater Lake National Park listed 564 species (Applegate 1939) and was published ten years before he died at the age of 82. In his flora he acknowledged Wynd's earlier work as well as that of Coville and Merriam. Most of Applegate's collections are housed in the CLNP herbarium.

Research Natural Areas

Reseach Natural Areas (RNAs) are designated to represent significant, undisturbed ecosystems, where natural processes can take place unhindered. These sites are valuable for scientific research and as a reservoir of native plants and animals. These sites are designated administratively by state or federal agencies and do not require congressional action. They are chosen to represent specific "cells" described in a statewide natural heritage plan. Four such areas have been designated in Crater Lake National Park (Mark 2000). The state's Natural Heritage Plan can be found at http://oregonstate.edu/ornhic/publications.html.

The Pumice Desert RNA consists of 3,055 acres along the North Entrance road northwest of the Crater Lake rim. It represents a barren pumice and ash desert surrounded by lodgepole pine forests. Ecological succession and slowly encroaching lodgepole pine are being studied and monitored (Horn 2002).

The Desert Creek RNA includes 1,869 acres in a remote northeast portion of the park. It includes a remnant plant community of bitterbrush (*Purshia tridentata*) and old growth ponderosa pine. Outside the Park similar communities have been logged or grazed.

The Llao Rock RNA consists of 435 acres of thick pumice deposits and represents subalpine timberline typical of southern Cascade pumice fields. Two rare plants can also be found there: the Crater Lake rock cress (*Arabis suffrutescens* var. *horizontalis*) and the pumice grapefern (*Botrychium pumicola*). Llao Rock also contains a whitebark pine plot that is part of a larger program within the park to monitor whitebark pine communities.

Sphagnum Bog RNA along the Park's western border includes 180 acres with plants that contrast sharply with the surrounding pumice dominated forest. The insectivorous sundews (*Drosera anglica* and *D. rotundifolia*) grow here as well as the rare Mazama collomia (*Collomia mazama*). Sphagnum Bog contains a diversity of plant communities that makes it an outstanding example of a Cascade bog or mire.

Mahala mat (*Ceanothus prostratus*) and snowbrush (*Ceanothus velutinus*) illustrated by Charles Yocom. Reprinted from Shrubs of Crater Lake National Park.

Lean Years and Re-vitalized Botany

Park budgets declined during the 1930 Depression years and World War II (1940s). Many plans, projects, and programs were postponed for lack of funding and staff (Mark 1990). An increase in activity came with the 1950s.

Charles Yocom

One notable effort in the 1950s was the work by Charles Yocom (1914-1985), a seasonal naturalist in 1951 and 1952. A skilled illustrator who learned his trade drawing plants used by waterfowl, he developed an interest in the Park's shrubs. He left an illustrated manuscript with the Park which was later published by the Crater Lake Natural History Association (Yocom 1964). He went on to illustrate other popular publications and became a professor of wildlife at Humboldt State College (N. Simmons, pers. comm.).

Richard M. Brown

Interest in botanical exploration within the Park got a boost with Richard M. Brown (1926-1998), who began his career at Crater Lake as a seasonal naturalist in 1952. He then became Assistant Park Naturalist (1953-1960), Chief of Interpretation (1963-1966), and Research Biologist (1967-1970). He held a Masters from Harvard and put his training in plant taxonomy to good use by adding to the Park herbarium. He also recruited energetic, skilled seasonal naturalists and encouraged them to pursue research within the Park. He helped create a library in the Park, which was dedicated as part of the CLNP centennial celebration in 2002 as the Richard McPike Brown Memorial Library.

Dwayne Curtis

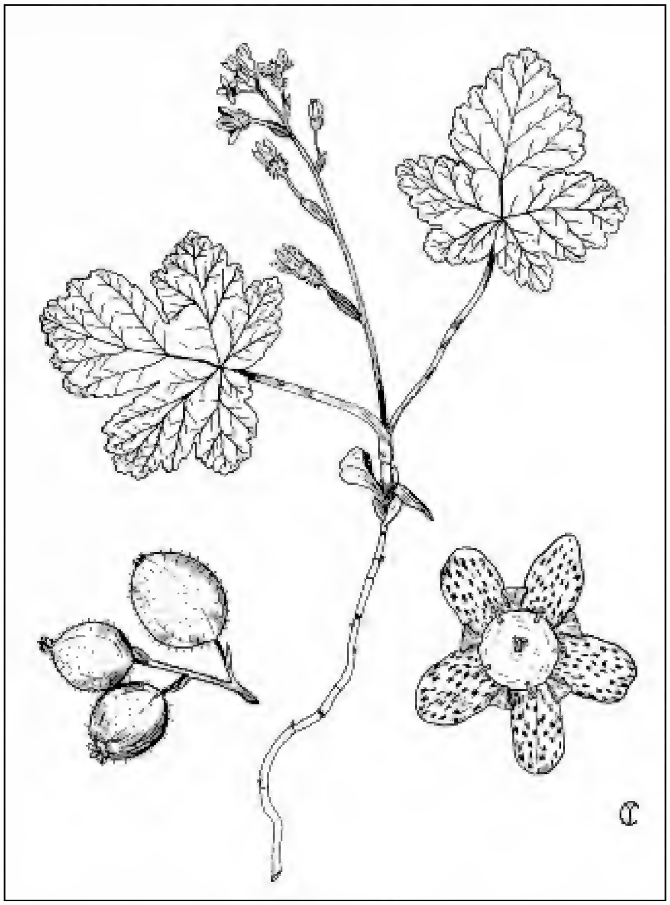
Curtis of Chico State College was a seasonal naturalist in 1966 and 1967. During that time he pursued his interest in slime molds and collected within the Park, finding eight species new to Oregon (Curtis 1969).

Elizabeth L. Horn

Horn of Purdue University was a seasonal naturalist in 1964 and 1965. Richard Brown encouraged her to study the Pumice Desert, a five square mile dry meadow in the northern portion of the Park. Horn spent lieu days (off-duty time) on the desert and many other seasonal employees assisted with field work. The study showed only 14 species of plants inhabited the area and covered less than 5% of the surface (Horn 1968). Subsequent monitoring showed that succession is slowly proceeding: in one plot, lodgepole pine numbers increased 75% over 35 years (Horn 2002).

Marion T. Jackson, Adolph Faller

Jackson from Indiana State University was a seasonal naturalist from 1965-1966. He became intrigued by the vegetation of



Charles Yocom's illustration of Crater Lake currant (*Ribes erythrocarpum*). Reprinted from Shrubs of Crater Lake National Park with permission from the Crater Lake Natural History Association.

Pumice slope west of Llao Rock, with Hillman Peak in the background. Foreground vegetation is primarily spreading phlox (*Phlox diffusa*) and Newberry knotweed (*Polygonum newberryi*). Photo by E. Horn.

Wizard Island while conducting boat tours. Brown encouraged Jackson and another seasonal naturalist, Adolph Faller, to study vegetation patterns on the volcanic island in 1966. Jackson returned again in 1969. Jackson and Faller spent their lieu days on the island, taking the morning tour boat to the island and returning on the last trip of the day. They described five different plant communities on the island: cinder slope, crater rim, lower cone, north slope, and lava flow (Jackson and Faller 1973). In addition, Jackson conducted a floristic survey, recording 106 species on the volcanic island, including 33 not previously noted (Jackson 1973). Looking back, Jackson commented on what could be accomplished with little funding or grant support (M. Jackson, pers. comm.).

The Role of Fire

During the 1970s and 1980s emphasis shifted to the study of fire ecology at Crater Lake National Park. Much of this work was done cooperatively through partnerships with Oregon State University and the University of Washington. Forest ecologists looked at fire regimes and wondered if it was possible to return portions of the Park landscape to pre-settlement vegetation patterns.

Donald Zobel, Robert McNeil, Robert Zigler

Zobel of Oregon State University looked at vegetation patterns during the mid-1970s, documenting fire history as background for initiating a prescribed fire program. He focused work on the southeast corner of the Park known as the panhandle. Graduate student Robert McNeil examined vegetation patterns and fire history of an *Abies concolor-Pinus ponderosa* forest inside the southern boundary of the Park. Zobel and McNeil correlated the vegetation with fire frequency, noting that the occurrence of a widespread fire appeared to reduce the size and intensity of fires occurring in the same area for the next ten years. They also noted changes in forest composition that may have resulted from the exclusion of fire (McNeil and Zobel 1980). Another graduate student Robert Zigler did similar studies on *Pinus contorta* forests within the Park (D. Zobel, pers. comm.).

James K. Agee, Terri Thomas, Christopher Chappell

Agee has studied fire within CLNP since the mid-1970s. He first visited Crater Lake while working for the National Park Service in San Francisco, where he was involved in fire regime studies in the Sierra Nevada. Crater Lake administrators had seen prescribed fire used in the Sierra Nevada and wanted to know what techniques could be applied at CLNP to restore historic forest systems. When Agee transferred to the Seattle NPS office as an ecological and research biologist, CLNP became part of his responsibilities. He directed graduate student and seasonal employee Terri Thomas' study of the effects of fires on woody debris accumulation (Thomas and Agee 1986). Another graduate student, Christopher Chappell, studied the reburning of *Abies magnifica* forests when a fire was allowed to burn in 1980 around Crater Peak (Chappell and Agee 1996). The summer of 1988 was a turning point for natural fire on federal lands. At Crater Lake, managers were letting the Prophecy Fire near Mount Scott burn as a natural fire when it blew eastward out of the Park. The Yellowtone fires of the same year prompted the suspension for many years of federal plans to allow natural fires to burn when prescribed conditions were met. In 1988 Agee became chair of the Division of Forest

Ponderosa pine forest with understory of snowbush (*Ceanothus velutinus*) and sagebrush (*Artemisia tridentata*) found in the southeast and northeast corners of CLNP. Photo by E. Horn.

Lodgepole pine (*Pinus contorta*) forest in Munson Valley. Photo by E. Horn.

Resources Management at the University of Washington. He continues, with cooperators, to study the effects of prescribed fire throughout the Pacific Northwest, including the effects of timing (spring or fall) of prescribed fires and insect infestation on tree mortality in CLNP (J. Agee, pers. comm.).

Current Crater Lake Botanists

Peter F. Zika

The historical plant lists compiled by Wynd and Applegate were recently updated and expanded by Peter F. Zika, who began park survey work through the Oregon Natural Heritage Program during the summers of 1994 and 1995 (P. Zika, pers. comm.). Additional field work and examination of herbarium specimens led to "A Crater Lake National Park Vascular Plant Checklist." Published through the Crater Lake Natural History Association, Zika's list documents 682 species, including locations. The publication lists the narrow endemics of Crater Lake and the Park's immediate surroundings, including *Botrychium pumicola*, *Collomia mazama*, and *Ribes erythrocarpum*. Other southern Oregon endemics found in the Park include *Arenaria pumicola*, *Castilleja applegatei* ssp. *applegatei*, and *Polygonum cascadense*. Species that have not been seen since early collections are noted, providing botanists the opportunity to search for them (Zika 2003).

Michael Murray

Terrestrial ecologist Michael Murray oversees the current botany program at Crater Lake. Having studied fire-dependent ecosystems in diverse locales such as Redwood National Park, Alaska, and the northern Rocky Mountains, Murray monitors fire effects at CLNP, as well as coordinates programs for revegetation, exotic species, and whitebark pine restoration. The fire monitoring program involves inventorying "preburn" vegetation in anticipation of natural fires to provide a baseline for comparison after a fire occurs. Murray also coordinates the cooperative fire regime studies with researchers at the University of Washington, Oregon State University, and Portland State University. For a description of his whitebark pine ecosystem studies, see Murray's article on page 25.

Mark Buktenica

Mark Buktenica, CLNP's aquatic biologist since 1985, researches moss in Crater Lake. Aquatic moss rings the lake to a depth of about 100 to 450 feet. Earlier evaluations of the extent of the moss and its associated epiphytes and invertebrates indicated the biomass of the moss could dwarf any other biological component in the lake. That would make it a significant player in the lake's nutrient dynamics (Buktenica 1996). A remote-operated submersible robot will be used during the summer of 2005 to further evaluate the moss beds and their associated aquatic life. (M. Buktenica, pers. comm.).

Steve Jessup

While Buktenica is looking at moss beneath the lake's surface, Steve Jessup of Southern Oregon University is surveying the mosses along the lakeshore. There, an environment shaded by steep caldera walls in proximity to the cold water of the lake creates a cool, moist habitat for species of mosses and liverworts that are normally found further north. Partially funded by the Crater Lake Natural History Association, Jessup's two-year survey began in 2004. One of the first moss specimens he found was a species not previously recorded elsewhere in the Pacific Northwest, the closest known location being at higher elevations in the Rocky Mountains (S. Jessup, pers. comm.).

Mountain hemlock (*Tsuga mertensiana*) and whitebark pine (*Pinus albicaulis*) along Garfield Peak Trail. Photo by E. Horn.

Conclusion

Crater Lake National Park is well known for its geological gem, the deep blue lake. It is less well known for its botanical treasures. Early botanists had the pleasure of exploring, identifying, and characterizing its species and plant communities. Although CLNP is relatively small by national park standards (about 250 square miles), it teems with a diverse flora. Ranging from 4,000 feet in elevation in the southwest corner to the nearly 9,000 foot Mount Scott along the eastern rim of the lake, CLNP straddles the Cascade crest with plant communities representing both the western and eastern slopes. Much of the lake's rim holds snow well into the summer and water flows through porous lava to create spectacular wildflower displays in the dry forest. Current botanical programs, built on knowledge accumulated by the park's earlier botanists, emphasize preservation and ecology: whitebark pine, plant associations, succession, and fire ecology. CLNP is an ideal outdoor laboratory in a breathtakingly awesome setting. A magical place to botanize–that's Crater Lake National Park.

Acknowledgments

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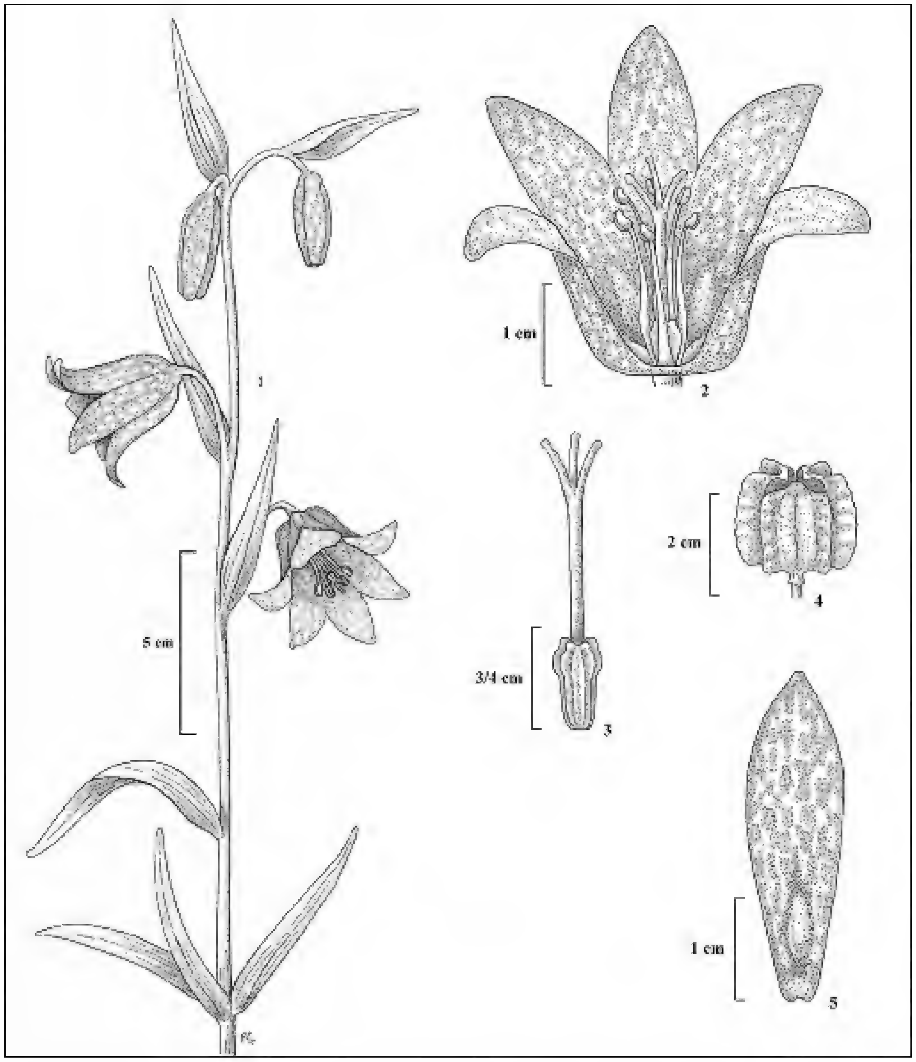
Elizabeth L. Horn began her love affair with Crater Lake National Park while a seasonal naturalist and did graduate work there leading to a MS from Purdue University (1966). She has published several popular wildflower guides covering the Oregon coast and the Cascade and Sierra Nevada mountains. She retired from the US Forest Service and lives in West Yellowstone, Montana, but returns to Crater Lake often to monitor her plots in the Pumice Desert.

Gentner's Fritillary
The Discovery and Protection of a Rare Species

Georgie Robinett
Freedom Plaza 5524, 13373 Plaza del Rio Blvd., Peoria, AZ 85381

Rare plants are often accidentally discovered. Sometimes amateurs find them. *Fritillaria gentneri* was first noticed in the spring of 1942, while 18-year-old Laura Gentner was pursuing one of her favorite pastimes, bicycling the back roads of Jackson County. Her bicycle gave her an excellent vantage point for admiring the wildflowers she sometimes collected for her parents' garden in Medford. From this trip, however, she brought home a fritillary unlike the two she was accustomed to seeing on her wildflower jaunts, *Fritillaria recurva* and *F. affinis* (historically also known as *F. lanceolata*).

The following spring Laura could not find the new fritillary again. However, the year after that (1944), Laura's sister Katherine recognized it in a bouquet of wildflowers a friend had picked. Before long, the source was traced to a location south of the town of Jacksonville, about seven miles away. Laura and Katherine's father, Dr. Louis G. Gentner, was an entomologist who had imbued his family with a deep interest in natural history. His wife Lillian was a horticulturist, and the family enthusiastically investigated the flora and fauna of Jackson and Josephine counties. Their excitement in discovering what might be a new, undescribed wildflower can be imagined.



Fritillaria gentneri: 1, flowering stalk; *2,* cross-section of flower; *3,* pistil; *4,* capsule; *5,* outer perianth segment, face view. Illustration by Rena Schlachter.

Dr. Gentner, the Assistant Superintendent for the Southern Oregon Branch Experiment Station in Medford, was a friend of Dr. Helen M. Gilkey, Curator of the herbarium at Oregon State College. He promptly reported the discovery to her. At Dr. Gilkey's request, the Gentners sent her specimens for study, and in 1951 Gilkey published the new species in Madroño, the journal of the California Botanical Society. She honored the family by naming the new species *Fritillaria gentneri* (Gilkey 1951). In this paper, Dr. Gilkey outlined the distinction between *F. gentneri* and the plant it most closely resembled, *F. recurva*:

> "As brilliant in color as *F. recurva*, the blossom of this new form is consistently of a different shade of red; its flowering period begins two weeks later; the plant is typically more robust; and the flower shape so different that regardless of other dissimilarities, plants of the two entities can readily be distinguished from a car moving rapidly on the highway.
>
> Since the first report, it has been possible to make intensive studies of plants of both forms in all stages, not only in the field and from generous collections provided by Mr. Gentner, but also from plants grown at the Oregon State College Herbarium and in the Gentner garden. As a result of these studies, the "new" form appears, in the morphology of the flower as well as in the superficial aspects of the plant previously mentioned, so distinctly different from any species thus far described, as to merit specific rank and recognition. It is a pleasure, therefore, to describe this beautiful species and to perpetuate it in the name of the family who discovered it."

Disagreement over Species Status

Although it has been over 50 years since Gilkey's publication of *F. gentneri* in Madroño, it is still not universally accepted as a species. In the Royal Horticultural Society's Lily Year Book, Horton (1970) indicated that *F. gentneri* had "an uncertain status. It is said to differ from *F. recurva* in being more slender in most of its parts, but in having larger flowers…This somewhat obscure species hails from southern Oregon, where it is usually found in company with, or close to, *F. recurva*." In The Lily Yearbook of the North American Lily Society, Roger M. MacFarlane (1975) summarized Western fritillaries and dismissed *F. gentneri* as follows: "Large, darker coloured form of *F. recurva* with a more divided style and non-recurving tepals–but continuously connected to *F. recurva*." After visiting the Jacksonville Cemetery in May 1999 and photographing *F. gentneri*, British plantsman David King contributed the following to the North American Rock Garden Society's Bulbs of North America (2001): "[Its] status...as a species is unconfirmed and requires further study; maintaining it as a species is something of a political issue rather than a botanical one, since its rarity makes it a candidate for listing, and its presence would then be grounds for preservation of its habitat."

Fritillaria gentneri was recognized by Peck (1961) in the second edition of his Manual of the Higher Plants of Oregon and is on the working list of the Oregon Flora Project. *Fritillaria gentneri* is recognized as a species by Bryan Ness in his treatment of *Fritillaria* for Flora of North America (2002). The acceptance, however, is provisional: "a restricted endemic closely allied with *F. recurva* and *F. affinis*, with which it can be confused. Some evidence suggests it may represent a hybrid between those two species. More study is needed to determine whether it should remain recognized as a distinct species." Despite disagreements, it was listed by the US Fish and Wildlife Service in 1999, granting the species legal status: "Although *Fritillaria gentneri* may be of recent hybrid origin, it is considered to be a valid species. This rare, red-flowered lily is known primarily from Jackson and Josephine counties in southwestern Oregon… One additional small population has just been found in northern California, very close to the Oregon border" (US FWS 2003). For many years, it was believed that F. gentneri was endemic to the state of Oregon. But in 2003 Bureau of Land Management

Louis and Lillian Gentner flanked by vigorous plants of *Fritillaria gentneri* in their garden at 22 S. Groveland Avenue, Medford, April 19, 1950. Photo by Louis Gentner, provided by Laura Gentner Dunwald.

Louis Gustave Gentner

(1892-1980)

Louis Gentner, 1916, when he began as Assistant County Agent in Jackson County, Oregon. Photo courtesy of Laura Gentner Dunwald.

Louis Gentner, son of Katherine Kayser and Louis J. Gentner, was born in Portland on February 29th in the leap year of 1892. He became an entomologist, earning degrees from Oregon State College (BS, 1915; PhD, 1953) and the University of Wisconsin (MS, 1918). After completing his undergraduate work, he was hired as assistant county agent in Jackson County, where he met Lillian Pierce, whom he married in 1919. He worked as an entomologist in Wisconsin and Michigan from 1916 to 1930. Then he returned to Oregon to serve as the assistant superintendent at the Oregon State Branch Experiment Station at Medford until he retired in 1962 at age 70. His major work in the Rogue Valley was research on the biology and control of insect and mite pests of fruit trees. He also monitored coddling moth populations and weather conditions (in those days (1915) frost warnings were indicated by running up a flag in Medford). In 1937 he began testing performance of various strains of 21 varieties of alfalfa. After five years of research he selected a strain that had originally come from Provence, France, but was no longer available because of the war. He named the variety "Talent." His entomological expertise is credited with rescuing Jackson County alfalfa and clover seed crops in 1947 by diagnosing insect infestations in the fields. In 1950 he released *Chrysolina* beetles for control of the noxious weed *Hypericum perfoliatum*, that had invaded grasslands and oak savannas in southwestern Oregon. In retirement he remained professionally active, consulting with orchardists, judging horticulture exhibits at fairs in Jackson, Josephine, Coos, Del Norte and Siskiyou counties, and giving talks at various clubs and organizations. He was a charter member of the Oregon Entomological Society and world authority on flea beetles, a group of insects comprising about 400 species in North America and about 8,000 world-wide, 40 of which were discovered by Gentner. He identified thousands of specimens of flea beetles for other entomologists and published numerous scientific papers. His pencil drawings of insects are preserved in the Oregon State University archives. A year before his death at age 88, he donated his personal insect collection of about 50,000 specimens (representing 1,000 different species) to the Smithsonian Institution.

Lillian Pierce Gentner

(1892-1967)

Lillian's horticultural interests began early in life as her parents, Charles and Anna Laura Pierce, built the first greenhouses in Medford in 1907, which her mother operated. Lillian became an authority on roses, auricula primroses, chrysanthemums, and gladiolus. She was president of the Medford Garden Club in 1941-1942, and helped organize the Medford Rose Society in 1955. In addition to growing hundreds of varieties of flowers in her home garden, she gave talks and taught flower arranging, having attended a florist school in Seattle in 1948. She obtained a certificate in 1959 to teach flower arranging to adults, the first such certificate issued in Oregon. A member of the American Horticultural Society, she won many prizes at flower shows and competitions in Washington, Oregon, and California, became an accredited judge for the Primrose Society, and excelled in making corsages and arrangements with flowers from her garden for weddings and public events, as well as competitions. She was featured in a 1973 Sunset magazine article about the hardiness of aspidistra in Medford. In addition to her work with fresh flowers, she used native conifers in swags and corsages, learning the native flora along with her husband. While he was particularly interested in native plants as insect hosts, she utilized cones and fresh or dried flowers in artistic arrangements. One of these she named the Westcoast Wildwood Corsage, which contained parts of sugar pine, incense cedar, Oregon myrtle, redwood, western hemlock, mountain hemlock, western larch, lodgepole pine, Arizona cypress, and Sitka spruce cones, Siskiyou iris (dried pods), white oak acorns, and alder catkins. She provided a description with the corsage that not only named each species, but described its habitat and significance. In 1968 a sourwood tree (*Oxydendrum arboreum*: Ericaceae) was dedicated to her at the Claire Hanley Arboretum at the Hanley Historic Farm near Central Point.

Lillian's childhood home and the Pierce greenhouses that were built in 1907. When streets were constructed, this was at the corner of Crater Lake Avenue and Main Street in Medford. The buildings were torn down in the 1960s. Photo courtesy of Laura Gentner Dunwald.

Katherine Louise Gentner

(1920-2004)

Katherine Gentner as a young woman. Photo courtesy of Laura Gentner Dunwald.

Born in Madison, Wisconsin in 1920, Katherine moved with her family to Medford in 1930. She graduated from Medford Senior High School in 1940 and attended Southern Oregon College of Education in Ashland, 1940-1941. She held stenographic and later administrative positions in Oregon, Nevada, California and Michigan, at a hospital, bank, architect, engineering firm, a university, and city offices. In 1964 she became a manager for Fashion Two Twenty in Detroit, Michigan, then transferred to a Fashion Two Twenty Studio in Sacramento. When her mother died in 1967 she transferred to Medford to live closer to her father. She lived the rest of her life in the Rogue Valley, working and volunteering in various positions. She studied music while in Ann Arbor, Michigan in the 1950s, and later served as organist at First Church of Christ in Medford and First Presbyterian Church in Jacksonville. Her volunteer activities were extensive, in which she pursued her love of flowers and gardening, music, birds, and seashells, and poetry. She won a Golden Poet award for her poem, "Requiem" from the World of Poetry in Sacramento, California. The awards were presented at a World of Poetry ceremony at the Marriott Marquis in New York City in 1990. She developed a memorial garden as a tribute to her parents at 205 Lani Way in Talent, and invited the public to view it in October 1980. She vigorously supported the efforts to conserve *Fritillaria gentneri*, giving talks to service clubs, including the Jacksonville Garden Club, giving interviews to the press, and maintaining scrapbooks of articles and photos of the fritillary, which provided information used by the Jacksonville Woodlands Association to obtain grants toward purchasing land for habitat. She and other members of the family also donated money to the Association to preserve habitat (Larry Smith, pers. comm.).

Laura Gentner Dunwald

(1924-)

Laura Gentner, high school graduation photo in 1942. Photo courtesy of Laura Gentner Dunwald.

Louis and Lillian's younger daughter, Laura Beatrice, was born in Lansing, Michigan, but came to the Rogue Valley in time to start school in Medford, where she finished high school before attending Southern Oregon College of Education (in Ashland) for two years. Her higher education was interrupted by World War II and she worked a variety of wartime jobs ranging from teletypist at Camp White to sewing parachutes in Manti, Utah. She left Medford in 1941 and after the war worked for a number of years in sales and management in nurseries and seed businesses, including Paul J. Howard's California Flowerland in Los Angeles, California. During the 1950s and 1960s, while rearing her daughter, she worked as an interviewer and field supervisor for market and opinion research companies, then in a variety of positions for the California School Boards Association, and the Bakersfield City Elementary School District. In the 1980s, with a new husband, she worked with multi-level marketing companies; then in 1991 she returned with him (Lloyd Dunwald) to her Oregon roots, settling in Grants Pass. Since then, her interests have been in genealogy and computers (editing the Escapee's genealogy newsletter and organizing genealogy seminars for the club's annual reunions) and teaching seniors how to research their family histories and use their computers. Not surprisingly, she is currently working on the Gentner family history, and has an active interest in the "family lily," including the Fritillaria Festival sponsored by the Jacksonville Woodland Association.

Right: Lillian Pierce Gentner (center back) with her daughters, Laura Gentner Lynch (left) and Katherine Louise Gentner (right) and Laura's daughter, Anna (front), December 28, 1956, Medford, Oregon. Photo by Louis Gentner, provided Laura Gentner Dunwald.

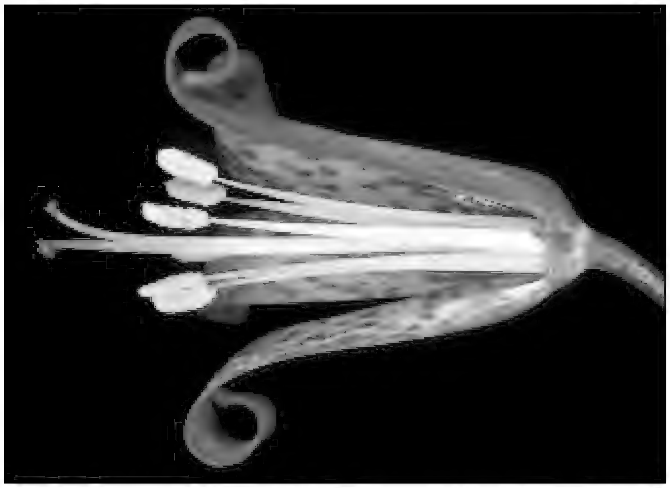
botanist Joe Molter discovered a small population of *F. gentneri* in northern Siskiyou County, California; and in 2004 a second population was documented about a mile from the first one. The California Native Plant Society recently added *F. gentneri* to its Inventory of Rare and Endangered Plants of California, which will encourage protection of these populations (Tomlinson 2005).

Field Observations by the Robinetts

My late husband Jim and I first saw *Fritillaria gentneri* in 1993 at the Jacksonville Cemetery, not far from the place Laura originally found it. At the time, there was no question in our minds that it was justifiably distinct from the many *F. recurva* and *F. affinis* we had seen over the years. Characteristics that the three species share (height, nodding flowers in the upper stems, one or more whorls of long, fairly narrow leaves) are basic traits common in other woodland fritillary species, such as *F. eastwoodiae, F. multiflora,* and *F. ojaiensis* in California and *F. atropurpurea*, which has a wider range. *Fritillaria gentneri* differs from *F. recurva* and *F. affinis* in flower color, shape, nectary glands, and style branches.

Flowers of *F. gentneri* are bluish red, usually darker than the scarlet (orange red) flowers of *F. recurva*; both are dotted with small, rectangular yellow tessellations. In southern Oregon, flowers of *F. affinis* are sometimes dominantly green, but more often a rather "dusky" brownish-purple, with scattered yellowish-green tessellations.

The tepals of *F. gentneri* curve slightly outward at the top before descending, and flare out gently at the tips, producing a bell shape (see cover photo). Tepals of *F. recurva* form a rather narrow cone in silhouette, with each tepal recurving back tightly on itself at the tip. In our experience, flowers of *F. gentneri* can be variable, ranging from nearly straight at the tips to curving out (but not fully

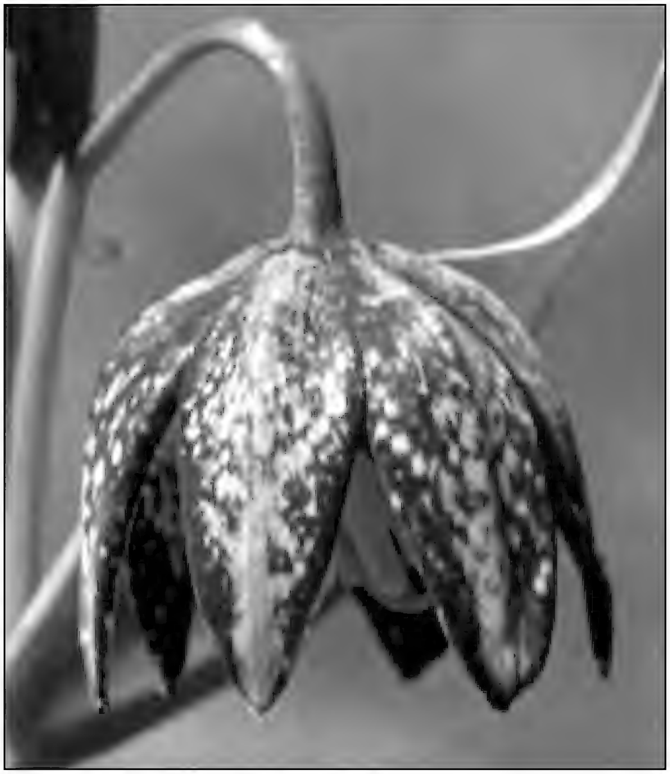


Longitudinal view of flower of *Fritillaria recurva*, with tepals removed, showing recurved tepals, short glands, and erect style branches. Photo by John Erwin.

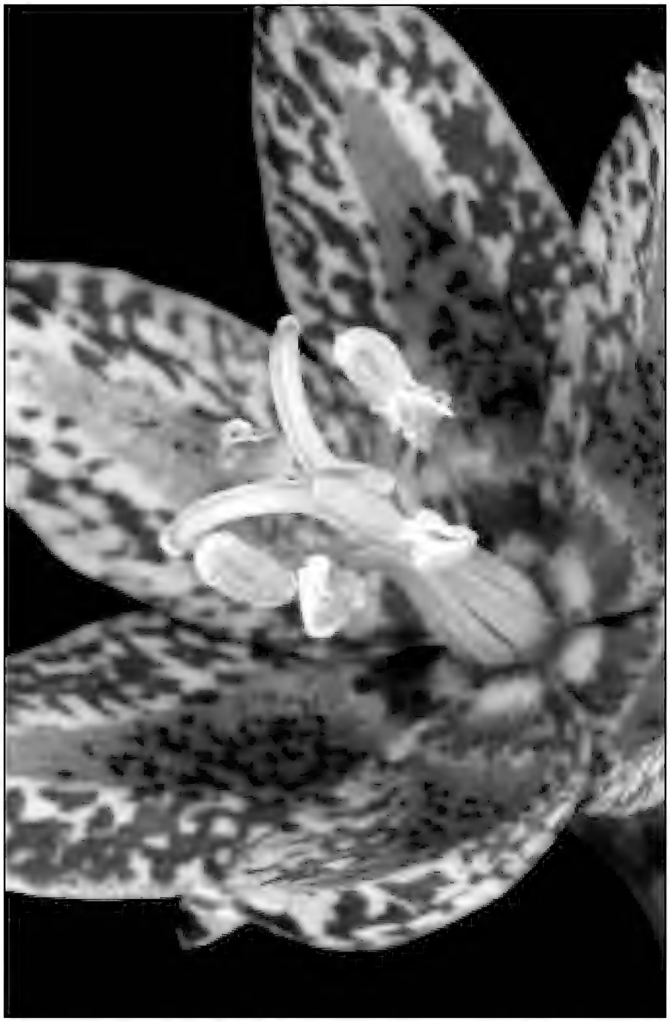
recurved). Flowers of *F. affinis* flare markedly outward at the top, then descend nearly straight or curve slightly inward, thus appearing like a six-sided down-facing box or cylinder.

Nectary glands located inside the tepals are another distinguishing feature. *Fritillaria affinis* has very large glands that extend for half or more of the length of the tepal. In *F. recurva* these glands are short, no more than one quarter the length of the tepal. Nectary glands of *F. gentneri* are about half the tepal length.

The style of *F. gentneri* is widely separated into three spreading branches for about half its length, while the style of *F. affinis*, though likewise deeply cleft, spread less widely. In *F. recurva* the style branches are usually quite erect and do not spread, except minutely at the tips.



Side view of flower of *Fritillaria affinis*, showing the broad shoulders that lend a box-like appearance. Photo by John Erwin.

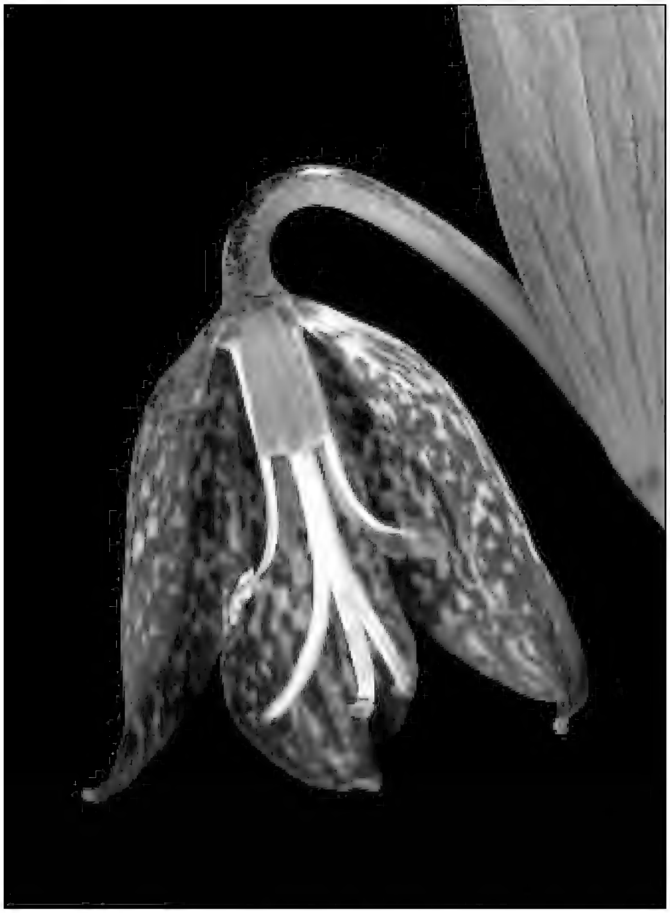


Glands in flowers of *Fritillaria affinis* extend more than half the length of the tepals, and the deeply cleft styles spread widely. Photo by John Erwin.

Both *F. affinis* and *F. recurva* can be found in a variety of habitats, from woodlands, to grassy slopes, to rocky and gravelly soils. Light conditions range from quite open to moderate shade. In contrast, *F. gentneri* is usually found on humus-rich, acid soils, under oak or fir trees, though some populations are found in other habitats, including dry forests, riparian shrub communities, grasslands, and chaparral.

Jim and I discovered what we interpreted to be F-1 hybrids between *F. affinis* and *F. recurva* in two different locations. In California, at Mendocino Pass (near the junction of the counties of Mendocino, Tehama, and Glenn), we found two fritillaries with flowers that were quite large and yellow-green, much like the typical Mendocino form of *F. affinis*, but with reddish-brown spots and tightly recurved tepal tips. The flowers of each assumed hybrid were narrower than those of *F. affinis* but wider than those of *F. recurva*; on one plant the flowers were nodding, while in the other they faced outward. There were about a dozen of the regionally typical form of *F. affinis* as well as about 30 typical *F. recurva* blooming within 20 feet of the variants.

In Oregon, along Interstate-5 on the south side of Siskiyou Summit, we came upon about 30 plants of the Siskiyou (dusky purple) form of *F. affinis* and about 50 *F. recurva* in a copse of stunted oak trees. Among them we found a single plant that had



Apparent hybrid between *Fritillaria affinis* and *F. recurva*, showing intermediate characteristics in the flower. Photo by Frank Lang.

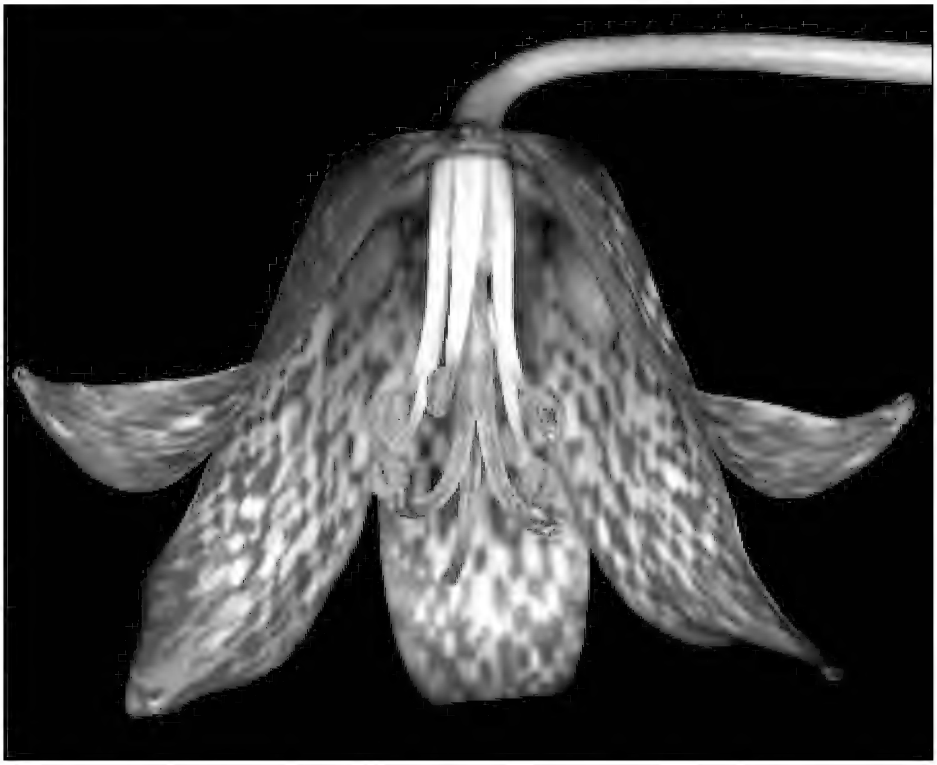
small, nodding, reddish-purple flowers with yellow-green spots. Its petals were somewhat splayed, but strongly recurved at the tips. In both this and the previous case, we interpreted these as F-1 hybrids between *F. affinis* and *F. recurva*. Another possibility is that they might have been backcrosses of a hybrid with one of the parents. In neither case were a sufficient number of plants present to warrant considering that either might be a valid separate species.

Efforts to Conserve *Fritillaria gentneri*

Laura left Oregon in 1944, as did Katherine several times over the years. When she returned to the Rogue Valley, Katherine became active in the preservation of the rare lily bearing their family name. *Fritillaria gentneri* was listed as endangered in 1995 by the Oregon Department of Fish and Wildlife. In 1997, the Native Plant Society of Oregon submitted a formal petition for Federal classification as an endangered species, which was granted by the US Fish and Wildlife Service in 1999. When Katherine learned that *F. gentneri* had been given federal status as an endangered species in need of protection, she was quoted in the Medford Mail Tribune: "I'm so glad they have done this. It has to be protected. It's found only in Jackson and Josephine counties. It grows nowhere else" (14 December 1999).

Jacksonville has long been proud of its special fritillary. The Jacksonville Garden Club uses its image as their logo, and the Jacksonville Woodlands Association sells sweatshirts with an appliqué of *F. gentneri* as a fund-raiser (http://www.jvwoodlands.org/wiki). Larry Smith, president of the Jacksonville Woodlands Association, whose yard supports 25 to 50 flowering plants of *F. gentneri*, leads field trips to see Gentner's fritillary in the woodland areas around Jacksonville. The Jacksonville Woodlands Association works with the City of Jacksonville, the Bureau of Land Management (BLM), Southern Oregon Land Conservancy, and Trust for Public Land to protect fritillary habitat by purchasing and receiving donations of land.

The City of Jacksonville also provides habitat protection in its pioneer cemetery and other natural open sites surrounding Jacksonville. The Jacksonville Cemetery, considered the central hub of the range for the species, supports a vigorous population of *F. gentneri*, with 300 to 600 flowering plants (US FWS 2003). [ed. note: Katherine Gentner related that she planted Gentner's fritillary bulbs over the graves of friends buried in the Jacksonville cemetery during the 1960s (Mark Mousseaux, pers. comm.)] After this population was badly damaged in the spring of 2001 by ground disturbance in the cemetery followed by invasion of yellow starthistle (*Centaurea solstitialis*), the City of Jacksonville



Side view of flower of *Fritillaria gentneri*, with tepals removed to show the glands and spreading style branches. Photo by John Erwin.

developed a conservation plan that included "*Fritillaria*-friendly grounds maintenance" (Amsberry and Meinke 2002). The Oregon Department of Agriculture's Native Plant Conservation Program, in cooperation with the BLM and the US FWS, cultivates bulbs for transplanting into new and existing publicly-owned habitats, and conducts research on conservation methods and on the biology and ecology of *F. gentneri*. Research also continues, using molecular methods to investigate the origin of the species and its relationship with other *Fritillaria*. Conservation and recovery efforts are coordinated by the Recovery Plan for *Fritillaria gentneri* (US Fish and Wildlife Service 2003).

Acknowledgments

My thanks go to Laura Gentner Dunwald of Grants Pass, OR, and to her sister, the late Katherine Gentner of Medford. As *F. gentneri*'s most ardent champions, they provided much of the impetus for the preparation of this article. Sadly, Katherine died in Medford on March 3, 2004. Laura contributed the biographical information for the Gentner family. Thanks are also owed Kelly Amsberry and Robert Meinke of the Oregon Department of Agriculture and OSU Department of Botany, for reviewing an earlier version of the manuscript. John Erwin, Frank Lang, and Laura Dunwald provided photographs. Rena Schlachter prepared the illustration of *F. gentneri* for the Oregon Flora Project. Frank Lang, Rhoda Love and Susan Kephart reviewed the manuscript. Finally, Linda K. Hardison, Chair of the Friends of the Oregon Flora Project in Corvallis, worked tirelessly in support of this article; without the editor's and her assistance, I could not have completed it.

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Georgie Robinett is a life member of both the Native Plant Society of Oregon and the California Native Plant Society and has been an active supporter of the Oregon Flora Project. She and her late husband Jim Robinett explored the field extensively for more than 20 years and formerly grew West Coast native bulbs from seed, marketing them world-wide. Together with Mark McDonough, they co-authored the article on *Alliums* in *Bulbs of North America*. Jim and Georgie also wrote articles for *The North American Lily Society Quarterly Bulletin* and for *Herbertia*. Now retired, she lives in Arizona and was until recently the editor of *Mariposa*, a quarterly newsletter devoted to the bulb genus *Calochortus*.

BOOK REVIEWS

Oregon Wild: Endangered Forest Wilderness

by Andy Kerr
2004. 240 pages. 168 color illustrations, 40 maps.
ISBN 0-9623877-8-3 Timber Press, Inc. $29.95, paper.
(Also available from ONRC 5825 North Greeley Avenue,
Portland, OR 97216; 503-283-6343).

Oregon is blessed with one of the most diverse landscapes in America. Each year thousands of people, both from the state and from afar, flock to places like Mount Hood, Crater Lake, and Eagle Cap to enjoy Oregon's natural beauty. But while visitors flock to well-known places, just off the beaten track are pristine lands and rivers that most Oregonians have never heard of—and all too often these sensitive places are under threat. In his new book, *Oregon Wild: Endangered Forest Wilderness*, veteran Oregon conservationist and author Andy Kerr explores the threatened wild lands of the state, and makes a compelling case for their protection. Part celebration of Oregon's natural heritage, part political commentary, Kerr's book seeks to educate and entertain readers while at the same time building a powerful case for the preservation of Oregon's remaining wild lands as federally protected Wilderness.

Oregon Wild: Endangered Forest Wilderness is a handsome book. Printed in coffee-table format, it uses beautiful photographs and maps to explore awe-inspiring roadless landscapes ranging from the moss-draped rainforests of the Oregon coast to the arid landscapes of Hells Canyon and the world-class biological wonders of the Klamath-Siskiyou region. The heart of the book is a series of detailed profiles of roadless wild lands around Oregon, some within national forests, others managed by the Bureau of Land Management. Grouped by geographic region, the chapters read like a wilderness lover's "must see" list, combining jaw-dropping photographs with detailed explanations of why these lands are ecologically important and worthy of preservation. The book has been carefully researched, and describes native plants found in each area, their ecological values, and in some cases why their presence alone justifies protection of the land.

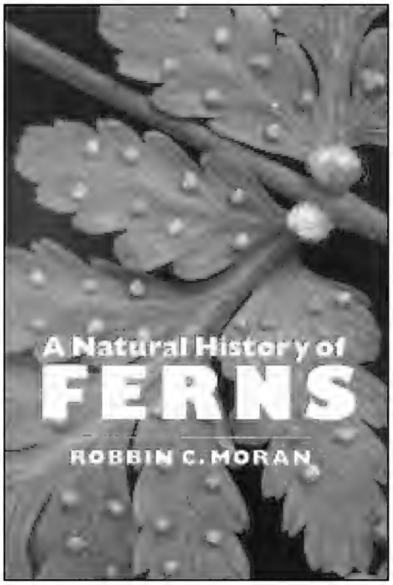
Beyond the profiles and gorgeous pictures, Kerr offers the natural and political history of Oregon's landscape. He starts with a fascinating look at how Oregon's forests evolved, the major eco-regions and forest types, and the wildlife they support. He details the politics of wilderness in Oregon, from the sad history of clearcut logging that destroyed much of our old-growth forest to the deal-making that lead to the creation of our existing wilderness areas.

Andy Kerr's writing is acerbic and entertaining. A veteran of 30 years of work with the Oregon Natural Resources Council (ONRC), Kerr was instrumental in the creation of many of Oregon's wilderness areas. Humorous, sometimes fiery, metaphors enliven descriptions of rare plants and landscapes, and the political wrangling over their fate. The author strives to inspire and motivate the readers, and to build support for preserving these special places, not just to entertain or encourage readers to visit the threatened landscapes. Produced by the Oregon Natural Resources Council, the book is part of ONRC's campaign to add five million acres of additional wildlands to Oregon's current fragments of protected wilderness.

–Candice Guth, Portland Chapter

A Natural History of Ferns

by Robbin C. Moran
2004. 301 pages. Illustrations, photographs, includes bibliographic references and index. ISBN 0-888192-667-1 Timber Press, Inc. $29.95, hardcover.



Much of my professional career was spent dealing with ferns: looking for ferns, teaching about ferns, reading about ferns, researching ferns. In the systematic botany class I taught at Southern Oregon University for over 30 years, 15 or 20 students who took the course each year studied ferns and fern allies in the early spring before the wildflowers were in full bloom. I spiced up the exercise with fern stories and fabulous facts about the world of spore-producing vascular plants.

When I read Robbin Moran's book I was very pleased to find the stories that I had told retold by the author in much the same way and to discover new stories about the ferny world, previously unknown to me, that were based on Robbin's vast experience and travels. There are stories about the "Pteridomania" that swept Victorian England, the Vegetable Lamb of Tartary, the Potato Fern of South America, and why eating bracken fern fiddle heads is a very bad idea. You probably have no idea what the consumption of Nardoo, an Australian *Marsilea* and survival food, will do to your digestive tract.

The book is written in an engaging, humorous style and is nicely illustrated with line drawings (some by the author), black and white and color photographs (most by the author), maps, and graphs. The book's forward was written Oliver Sachs, a neurologist, best known as the author of *Awakening, The Man Who Mistook His Wife for a Hat,* and *Oaxaca Journal.* As it turns out, Sachs is also a "Pteridomanic." His *Oaxaca Journal,* is an account of his adventures in Mexico with fern notables, like John Mickle of the New York Botanical Garden and others like Robbin Moran. Sachs likes Robbin's book, so do I, and so will anyone else interested in the plant kingdom.

–Frank Lang, Siskiyou Chapter

Columbines Aquilegia, Paraquilegia and Semiaquilegia

by Robert Nold

2003. 158 pages, 41 color photos, 6 color illustrations, bibliography, index. ISBN 0-88192-588-8 Timber Press, Inc. $24.95, hardcover.

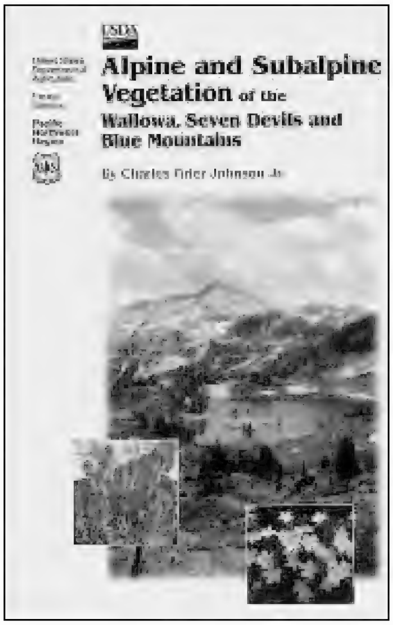
This beautiful book will appeal to both gardeners and botanists. The author's detailed and humorous style makes such topics as the etymology of *Aquilegia*, its taxonomy, and pests and diseases into enjoyable reading, while still providing all the facts. Robert Nold's 1999 award winning monograph on *Penstemons* is a favorite of mine; his new book appeals to my inner gardener. He includes practical chapters about propagation and cultivation to guide gardeners through horticultural questions about these frequently misunderstood groups of plants. He examines in detail 65 species of *Aquilegia* with a complete summary of cultivavation needs, biology, and history.

Nold also describes plants of the genera *Semiaquilegia* and *Paraquilegia,* by creating a clear and useful overview of these "columbine cousins." In addition to striking color photographs of columbines in wild settings and in gardens, exquisite watercolor illustrations by the author's wife, Cindy Nold, further brighten the text.

Nold's enthusiasm for growing columbines is contagious from the reading. His approach to gardening is low maintenance and natural. He urges the reader to give columbines a chance in their garden since they are so easy to grow: "Here the mysteries of growing columbines are fully revealed for the first time. Buy a plant, dig a hole in any old soil in full sun or dappled shade, put that plant in the hole, push dirt around the plant, and water it."

Columbines offer the gardener a wide choice of color, from buttery yellow to the most divine purple, for the enhancement of any garden space. For the botanist, there are simple taxonomic keys divided into Asian, European, and North American species.

–Lusetta Nelson, Siskiyou Chapter


USDA
Alpine and Subalpine Vegetation of the Wallowa, Seven Devils and Blue Mountains
By Charles Grier Johnson Jr.

Alpine and Subalpine Vegetation of the Wallowa, Seven Devils and Blue Mountains

by Charles Grier Johnson, Jr.

2004. 632 pages, keys, color photos, line drawings, glossary, bibliography. Publication R6-NR-ECOL-TP-03-04 USDA Forest Service, Pacific Northwest Region, Portland, Oregon, soft cover.

Unlike other government publications, this book is a labor of love. It is Charlie Johnson's career capstone, the culmination of his years spent at the highest elevations in northeastern Oregon between 1964 when he became one of the first wilderness guards in the Eagle Cap Wilderness and his retirement as Wallowa-Whitman Forest Ecologist in 2004. His aim was to "assist managers in maintaining and enhancing the fragile ecosystems" and to help visitors "better understand and appreciate the magnificent diversity of plants and plant communities… in these high altitude landscapes." The first half of the book describes the plant communities, starting with an introduction to the mountain ranges: Wallowa, Seven Devils, Elkhorn, Greenhorn, Strawberry, and Aldrich, giving an overview of the vegetation, geology, and climate of each. He defines the ecological terminology and presents management considerations for each of the forest, shrubland and grassland community types. Following the key to the series and associations are the descriptions for each, including a photo of a typical stand, distribution, environmental features, soils, vegetation composition, successional relationships, disturbance ecology, and a data table. The second half of the book contains descriptions for all the plant species used as indicators for the vegetation types: 14 trees, 24 shrubs, 19 grasses, 10 sedges and rushes, and 87 forbs, each illustrated with a color photo and line drawings. Unfortunately, the nomenclature has not been updated, but until Hitchcock and Cronquist's Flora of the Pacific Northwest is replaced by a new Oregon Flora, this may be more practical for field work. I find only one negative comment to make concerning this book and it has nothing to do with the content. It is the weight. Stash this book in your backpack for a climb into the alpine and subalpine landscapes and you'll wish you had one of the packstrings pictured in the introductory pages. How can you acquire a copy? At press time, it was available in limited quantities from the Wallowa-Whitman National Forest Headquarters in Baker City (PO Box 907, Baker City, OR 97814). The future plan is to also sell the book at bookstores in the Pacific Northwest.

–Cindy Roché, Siskiyou Chapter

Field Guide to the Cascades and Olympics, *2nd Edition*

by Stephen R. Whitney and Rob Sandelin.

2003. 320 pages, color photographs and illustrations, index. ISBN 0-89886-808-4 The Mountaineers Books, $19.95, paper.

Interested in the natural history of the Cascade and Olympic Mountains of the Pacific Northwest? Want to be able to identify the creatures, plant and animal, you might encounter on your wildland ramblings? This might be the book for you.

This basic picture-book manual identifies some of the plants and animals you might encounter in the Cascade Mountains in Oregon. The authors discuss various plant communities, geology, fungi (39 taxa), ferns (32), flowering plants (260), shrubs (93), trees 42), insects (43) including butterflies (54), trout and salmon (11), amphibians (21), reptiles (22), birds (135), and mammals (58). These approximate numbers reflect mention of the taxa. There are fewer illustrations. Bryophytes and lichens are not covered. Grasses and grass-like are only mentioned in the discussion of wetlands. Color photographs illustrate the biotic communities and rock types. The organisms are illustrated by color paintings. Unfortunately, the printing does not do justice to the artwork. Light colored flowers vanish into the white background of the pages and fine detail is lost.

Among its innovations is the color index on the cover that corresponds to exposed colored sections visible on the closed page of the book opposite the binding: brown for mushrooms, gray for butterflies, black for mammals, and red for flowers, flowers of any color. It is a quick efficient way to get to an organism of interest.

Once you are among the flowers, you will find them arranged by flower color, then by family, genus and species, with a common name. They use the term "flowering plant" to include the gymnosperms and angiosperms (page 78). This does not build confidence in the quality of their work. Also, the illustration of *Polypodium hesperium* is probably the blunt segment version of *P. glycyrrhiza*. *Polypodium hesperium* has larger oval sori. The illustration and discussion of meadowrue flower color are incorrect. The main illustration clearly shows stamens. The inset might be female flowers with akenes, not male flowers as labeled.

Flowering plant families seem to be arranged in the order of Engler and Prantl (an older, common, system of plant classification), used in many older floras. It starts with the monocot families like lilies and orchids, and then proceeds to dicot families without petals, to those with separate petals ending with the sunflower family. This system is repeated for each flower color group. The quickest way to locate a flower color is to leaf through the pages until the color is found or look in the Contents under Chapter 5.

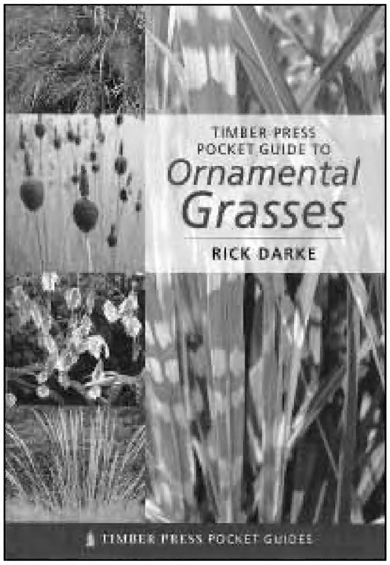
On second thought, you might want to take a close look at Daniel Mathews' 1999 Cascade-Olympic Natural History, (2nd ed., Raven Editions) for $24.00. Although it costs a little more and there is not as much color, it features a wealth of natural history information, nice line drawings, and phonetic pronunciation of scientific names. Best of all, Daniels does not consider the conifers (gymnosperms) flowering plants (discussed on pages 15-16 and 577).

–Frank Lang, Siskiyou Chapter

Pocket Guide to Ornamental Grasses

by Rick Darke.
2004. 226 pages, color photographs, index.
ISBN 0-88192-653-1 Timber Press, Inc., $19.95, flexibind.

This pocket guide was developed as a portable complement to the author's *Color Encyclopedia of Ornamental Grasses*. The grasses (and more than a few other taxa that serve similar purposes in the garden) are arranged alphabetically by scientific name. Darke recommends that readers who are a few years behind in their grass nomenclature use the index in the back for a cross reference to the new names. Unfortunately, his cross-referencing could be better. For example, under *Stipa* the index directs you to *Austrostipa* on page 43, *Hesperostipa* on page 108 and *Stipa* on page 196. It does not clue you to *Achnatherum* on page 29 or *Nassella* on page 150. For those you have to look under "needlegrass," even though they formerly bore the name *Stipa*. Genera from other families (sedges, rushes, restios and cat-tails) include *Carex, Chondropetalum, Cymophyllus, Cyperus, Dulichium, Elegia, Eleocharis, Isolepis, Juncus, Luzula, Rhynchospora, Schoenoplectus, Scirpus, Typha*, and *Uncinia*.



My interest in this book stems from a fascination with grasses, both native and naturalized. Knowing that many of our weedy species started as ornamentals, I was curious about the range of grasses in cultivation and whether the author cautions against planting those with records of invasiveness. He warns gardeners of the weedy nature of *Phalaris arundinacea* ("a major threat to marshes and other native wetlands"), as well as *Holcus lanatus* ("self-sows readily") and *H. mollis* (tendency for "aggressive spread"). However, he fails to mention that *Cortaderia* (pampas grass) escapes cultivation in California and western Oregon, and that few means short of a backhoe can remove well-established plants.

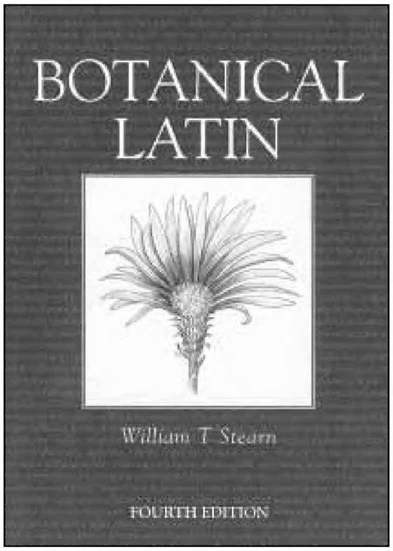
While the book is filled with color photos, I don't find it particularly helpful for identifying or learning new grasses. To be fair, the purpose of the book is a horticultural guide, and there are some that I suspect I could recognize in a heartbeat, maybe from the name alone: fiber-optics plant or mop-sedge (*Isolepis cernua*), for example. The introductory chapter discusses selection and management of grasses for cultural settings, including running and clumping growth habits, warm and cool growing seasons, sun and shade, soils, fertilization, moisture, diseases and pests, planting and mulching, weeding, cutting back and burning, dividing and transplanting. This discussion is followed by lists of ornamental grasses suited to specific purposes or effects.

In addition to describing horticultural zones appropriate for each cultivar, the author tells where each is native. Darke's compilation includes 21 Oregon natives that have entered the horticultural trade, including *Achnatherum hymenoides, Aristida purpurea, Calamagrostis canadensis, C. nutkaensis, Carex nudata, C. tumulicola, Deschampsia cespitosa, Eleocharis acicularis, Elymus glaucus, Festuca californica, F. idahoensis, F. rubra, Hierochloë occidentalis, H. odorata, Hordeum jubatum, Juncus effusus, J. patens, Koeleria macrantha, Leymus cinereus, L. mollis*, and *Spartina pectinata*. However, because many of these have wide native ranges, the integrity of our native systems might be better maintained by using seed from local populations rather than introducing genotypes from distant locations.

–Cindy Roché, Siskiyou Chapter

Botanical Latin, Fourth Edition

by William T. Stearn.
2004. 546 pages, 42 line drawings, index.
ISBN 0-88192-627-2 Timber Press, Inc.
$29.95, paper.



Originally published in 1966, this is the fourth edition of a classic reference. Botanical Latin has, over the course of scientific use for 250 years, become distinct from classical Latin, and incorporates many Greek terms. In addition to summarizing grammar and syntax, this handbook covers the origins of Latin and latinized geographical names, color terms, symbols and abbreviations, diagnoses and descriptions, the formation of names and epithets, and more. The vocabulary chapter comprises 170 pages of both English and Latin terms in alphabetical order; one could spend days browsing through the lists, muttering "So that's what that means!" Plant names that were just names before will ring with meanings, e.g., *botry-* or *botrys* for bunch, and *botryoides*, like a bunch of grapes. Perhaps the most practical advice from Stearn, the Dean of botanical Latin scholars, is on pronunciation: "How they [scientific names] are pronounced really matters little provided they sound pleasant and are understood by all concerned." If you have published a description of a new species or consulted earlier literature written in botanical Latin, you probably already know that this internationally renowned masterpiece is indispensible. It is also a valuable reference for anyone curious about plant names; you don't have to be describing new species or doing research in systematics to find this book useful.

–Cindy Roché, Siskiyou Chapter

Guide to the Common Potentilla Species of the Blue Mountains Ecoregion

by Marti Aitken and Catherine Gray Parks.
2004. 50 pages, key, illustrations, glossary.
General Technical Report PNW-GTR-603 USDA Forest Service,
Pacific Northwest Region, Portland, Oregon,
spiral-bound, water-resistant paper.

Are you the kind of person who, when looking at a cinquefoil, cannot be satisfied with leaving the identification to rest at *Potentilla* sp.? Have you ever been confounded by the nuance in interpretation called for in technical keys? Is that style truly "*slenderly* fusiform" and is its point of attachment really on the lower half of the ovary? What if, as in late season, the style has long severed its relationship with the ovary? This predicament has now been overcome, at least when one pursues potentillas in the Blue Mountains of eastern Oregon and southeastern Washington. Marti Aitken and Catherine Gray Parks, both of the Pacific Northwest Research Station Forestry and Range Sciences Laboratory (the research arm of the Forest Service), have crafted a nifty guide to *Potentilla* species found throughout the entire Blue Mountain region, including the Ochoco and Wallowa Mountains. The strength of this guide is a well-conceived dichotomous key that relies almost entirely on vegetative features. Though the reader may occasionally be requested to examine a flower's calyx, which fortunately in *Potentilla* is persistent season-long, he or she will never be asked to fathom a style's gross morphology or determine its relative point of attachment to the ovary.

Following the key, each species is briefly described alongside an illustration (borrowed from volume 3 of *Vascular Plants of the Pacific Northwest*) with one full page devoted to each of the 26 species covered. The descriptions include features of each species' habit, leaf morphology, pubescence, floral anatomy and habitat along with useful notes and taxonomic synonymy. Because the guide was prepared largely for an audience lacking a formal botanical education, technical botanical jargon is toned down, particularly with terms that describe patterns of pubescence. For those technical terms that simply could not be avoided, a glossary, illustrated where necessary, is included. Even with its less technical presentation, this guide should appeal to those with a stronger background in plant identification. Nomenclature follows the USDA NRCS *PLANTS Database*; however, the guide does include familiar species once classified by other authors under *Potentilla*, such as *Comarum palustre* (*P. palustris*), *Dasiflora floribunda* (*P. fruticosa*), and *Argentina anserina* (*P. anserina*). Preceding the key, the guide has a fascinating introduction to the genus *Potentilla*. Were you aware, for instance, that cinquefoil was reportedly an ingredient in medieval "love divinations" and fishing bait?

The need for this guide began as an exercise to help people distinguish native *Potentilla* species from the invasive exotic sulfur cinquefoil (*Potentilla recta*), a weed that often grows amidst and is believed to displace native potentillas. *Potentilla recta* can be easily confused with varieties of *P. gracilis* and to help avoid this confusion the dichotomous key treats the relevant varieties of *P. gracilis*.

The *Guide to the Common Potentilla Species of the Blue Mountains Ecoregion* is available free of charge from the Pacific Northwest Research Station in electronic and print format. A portable document file (pdf format) can be downloaded at http://www.fs.fed.us/pnw/pubs/gtr603.pdf and print copies may be ordered on line at http://www.fs.fed.us/pnw/publications/order.shtml or by calling (503) 808-2138. On your next trip to the Blue Mountains don't forget to bring a copy.

–Gene Yates, William Cusick Chapter

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Please consider that the readers of *Kalmiopsis* are people with varied educational backgrounds and all articles must be comprehensible to a broad, but relatively well educated, audience. The goals of *Kalmiopsis* are to disseminate correct information about and generate interest in native plants, thus each article is reviewed by the editorial board and selected technical reviewers before publication.

Contributions of artwork and photographs without accompanying manuscripts are welcome; color submissions must be suitable for publication in grayscale. Contact the *Kalmiopsis* editor to request a copy of Instructions to Authors, or to inquire about the suitability of an idea for an article.

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